MECHANICAL HANDLING

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TAKING STOCK

THE commencement of a new year is often the occasion to take stock, or to look back over the past twelve months and make plans for the ensuing year.

1959 has not been without its difficulties. We have had industrial disputes and many unfortunate unofficial strikes which have caused hardship to individuals and held up production.

On the whole, business has improved and we can face the future with confidence. The Institute of Materials Handling has held its first International Conference and it was, as reported in this journal, a great success. It is hoped in the future to run similar conferences every alternate year, the next being in the spring of 1961.

A most important event of the coming year is the SEVENTH MECHANICAL HANDLING EXHIBITION (organized by this journal) at EARLS COURT, LONDON, S.W., from Tuesday, 3rd May to Friday 13th May. This exhibition, first launched in 1948, with the support of the leading trade associations concerned, spotlighted the attention of British industry to the importance of the study of materials handling. The subject had previously been ignored by learned institutes and, of course, industry itself. Now we have a thriving Institute in this country and hardly any learned institute concerned with industry or the professions dare ignore the subject today.

Let us see that 1960 is marked by great strides forward to still better materials handling methods.

Pour les lecteurs de l'étranger
Für unsere ausländischen Leser
Para los lectores de ultramar

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For readers overseas

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Manutention des cargaisons de sel en vrac Page 4
Par J. M. Beskine, B.Sc.(Eng.)
Ce rapport technique de manutention mécanique traite d'une nouvelle installation d'une capacité de 350 tonnes à l'heure, à l'usine de sel de l'Imperial Chemical Industries, à Runcorn, Cheshire. Cette nouvelle installation offre de l'intérêt du fait qu'elle est compacte, que l'exploitation se fait dans la propreté, qu'elle a été conçue pour travailler économiquement et pour son adaptabilité générale.

Techniques de manutention dans les services de transports routiers anglais Page 13
Un nouveau dépôt vient d'être inauguré à Lowfell, Newcastle, par la British Road Services. De nombreux types de machines de manutention mécanique y sont en service, et cet article décrit les divers matétiels intéressants, ainsi que la méthode que la B.R.S. a adoptée pour la manutention à grande échelle de marchandises qui varient beaucoup par la forme, les dimensions et la poids.

Etude des plans d'installation d'usines
Par L. W. Bailey, F.R.Econ.S., A.M.I.Prod.E. Page 18
C'est un exposé qui a été lu devant la North Hertfordshire Productivity Association. Il contient un certain nombre d'illustrations, entre autres un exemple de schéma montrant les allées et venues d'un ouvrier entre onze stations de transformation/stockage. Il comporte également un grand schéma d'un tableau des déplacements des matériaux entre quatre zones déterminées avec trajets aller et retour dans ces zones aux points de transformation.

La manutention des materiaux dans une installation d'industrie lourde
Par W. Wolpert Page 25
On a apporté une attention considéabrle à la simplification de la manutention des matériaux dans le planning de la nouvelle usine de mécanique lourde de la firme Sulzer Bros., Ltd., dans le but de réaliser d'importantes économies sur le prix de revient.

Exposition de l'efficience et de la securité industrielles Page 28
C'est un compte rendu sur les articles intéressants concernant la manutention mécanique que l'on a vus à cette exposition, qui s'est récemment tenue à Manchester.

Elevateur pour wagons de chemin de fer Page 29
Pour permettre la manutention directe des marchandises, à tous les étages, dans l'entrepôt en douanes d'une société, un élévateur de wagons de 40 tonnes de capacité a été installé à Vienne. On dit qu'il s'agit là d'une réalisation unique en son genre et ce matérial est capable de lever un wagon entièrement chargé du niveau du sol jusqu'aux ler et 2ème étages.

Installation de transporteurs dans un entrepot de bananes
Par un rédacteur particulier Page 30
C'est une vaste installation de transporteurs aériens sans interruption qui traverse deux étages et qui passe de la baie de déchargement à travers un certain nombre de salles de mâturité.

Deux nouvelles pelles chargeuses Page 33
Où l'on fournit des précisions sur le Loadmaster 1000 et le Loadmaster 3000, deux nouveaux chargeurs Chaseside que l'on construit actuellement dans une nouvelle usine à Blackburn.

La manutention avec les chariots industriels —4ème Partie
Par L. F. Hoefkens, A.I.Prod.E. Page 37
Dans cette partie, Mr. Hoefkens change sa manière habituelle de décrire les chariots et leurs applications, pour traiter de l'application de l'étude du travail aux chariots industriels. Cet aspect est traité assez en détail et il est illustré par des croquis et un grand schéma.

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INHALTSÜBERSICHT AUF DEUTSCH

Salzförderung als Schüttgut Seite 4
Von J. M. Beskine, B.Sc.(Eng.)
Dieser fördertechnische Bericht beschreibt eine neue Anlage im Salzwerk Runcorn der Imperial Chemical Industries in Cheshire, die eine Leistung von 350 t/h hat. Die neue Anlage ist auf Grund ihrer gedrängten Bauart, Betriebssauberkeit, wirtschaftlichen Konstruktion und allgemeinen Anpassungsfähigkeit von Interesse.

Fördermethoden der British Road Services Seite 13
Ein neues Depot wurde kürzlich von der britischen Strassentransport-behörde bei Low Fell, Newcastle eröffnet. Zahlreiche verschiedene Förder- und Hebegeräte kommen dort zur Anwendung, und in diesem Artikel werden die verschiedenen Geräte und Anlagen beschrieben, von denen die 'B.R.S.' für den Grossumschlag von Gütern verschiedenster Formen, Abmessungen und Gewichte Gebrauch macht.

Betriebsanordnungsplanung Seite 18
Von L. W. Bailey, F.R.Econ.S., A.M.I.Prod.E.
Hierbei handelt es sich um ein Referat, das der North Hertfordshire Productivity Association vorgelegt wurde. Es umfasst eine Anzahl Abbildungen einschliesslich eines Schaubildes über den von einem Arbeiter zwischen 11 Verarbeitungs- und Lagerstellen zurückgelegten Weg. Ferner ist eine schematische Darstellung der Materialförderstrecken zwischen jeweils vier Stellen sowie der innerhalb dieser Gebiete von uns zu den Verarbeitungsstellen zurückgelegten Strecken vorhanden.

Förderanlagen in einem Schwerindustriebetrieb
Von V. Wolpert Seite 25
Eine grosse Bedeutung wurde bei der Planung des neuen Schwerindustriebetriebes der Fa. Sulzer Bros, Ltd., der Vereinfachung der Förderanlagen beigemessen, um auf diese Weise eine erhebliche Kosteneinsparung zu erzielen.

Ausstellung 'Betriebswirksamkeit und -sicherheit' Seite 28
Ein Bericht über die hervorstechenden fördertechnischen Darbietungen, die auf

dieser kürzlich in Manchester abgehaltenen Ausstellung zu sehen waren.

Eisenbahnwaggonhubwerk Seite 29
Um in einem Zollverschlusslager einer Firma den direkten Güterumschlag in allen Stockwerken zu ermöglichen, wurde in Wien ein 40-t-Waggonhubwerk installiert. Dieses soll in seiner Art einzigartig sein und kann einen vollbeladenen Güterwagen vom Erdgeschoss zum 1. und 2. Stock heben.

Förderanlage in einem Bananenspeicher
Von einem Sonderberichterstatter Seite 30
Ein grossangelegtes System von zwei Stockwerke bedienenden Überkopfförderern, das sich von der Ausladestelle über eine Anzahl von Nachreifräumen erstreckt.

Zwei neue Schaufellader Seite 33
In diesem Artikel werden Einzelheiten über den Loadmaster 1000 und den loadmaster 3000 gegeben. Es handelt sich hierbei um zwei neue von der Fa. Chaseside in einem neuen Werk in Blackburn hergestellte Schaufellader.

Materialförderung mit Industriefahrzeugen, Teil IV
Von L. F. Hoefkens, A.I.Prod.E. Seite 37
In diesem Beitrag sieht der Verfasser von der üblichen Beschreibung von Förderkarren und ihrer Anwendung ab und befasst sich mit der Anwendung von Griffelstudien auf Flurfördergeräte. Dieses Thema wird ausführlich behandelt und mit Hilfe von Skizzen und einem grossen Schaubild erläutert.

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SUMARIO EN ESPAÑOL

El manipuleo de cargamentos de sal a granel
Por J. M. Beskine, B.Sc.(Eng.) Pág. 4
Este informe técnico sobre el manipuleo mecánico trata de una nueva instalación, con una capacidad de manipuleo de 350 toneladas por hora, que se halla en la fábrica de sal de Runcorn, Cheshire, Inglaterra, que pertenece a la Imperial Chemical Industries. La nueva instalación es de especial interés debido al poco lugar que ocupa, a su functionamiento higienico, a su concepción económica y a su adaptabilidad general.

Metodos de manipuleo empleados por British Road Services
(Transportes por Carretera del Estado) Pág. 13
British Road Services han inaugurado un nuevo depósito en Low Fell, Newcastle. Se hallen en uso en el mismo muchos tipos diversos de equipo de manipuleo mecánico y este artículo describe algunos de los elementos más sobresalientes y el sistema adoptado por la Empresa para el manipuleo en gran escala de mercancías que varían en gran medida en cuanto a forma, tamaño y peso.

Planteo de la disposicion de una fabrica
Por L. W. Bailey Pág. 18
Se trata de un estudio leído ante la North Hertfordshire Productivity Association. Comprende diversas ilustraciones incluso un ejemplar de un diagrama de cuerda que muestra el viaje de un operador entre once puntos de fabricación/almacenaje. Hay también un gran diagrama que presenta el cuadro del transito de una materia entre cuatro zonas especificas y a y desde puntos de fabricación dentro de dichas zonas.

El movimiento de materiales en una gran instalacion industrial
Por V. Wolpert Pág. 25
Se ha estudiado muy detenidamente la simplificación del manipuleo de materiales al proyectar la neuva instalación de construcciones mecánicas pesadas de la Sulzer Bros., Ltd., con objeto de lograr una importante economía en los gastos.

Exposicion de eficacia industrial y prevencion de Accidentes Pág. 28
Un informe sobre los elementos de mayor interés relacionados con el manipuleo mecánico presentados en esta Exposición que tuvo lugar recientemente en Manchester.

Elevador de vagones de ferrocarril Pág. 29
Para que sea posible descargar la mercancía directamente en todos los pisos de un almacén aduanero de una Empresa, se ha instalado en Viena un elevador de vagones de ferrocarril con capacidad para 40 toneladas. Se dice sea un ejemplar único y es capaz de elevar un vagon completamente cargado hasta el primer y el segundo piso.

Red de transportadores en un almacen de platanos
Por un Colaborador Especial Pág. 30
Una amplia red de transportadores aéreos con circulación contínua por dos niveles de pisos. Conduce el producto desde el muelle de descarga a través de une seria de cámaras de maduración.

Dos nuevas palas cargadoras Pág. 33
Contiene detalles de la Loadmaster 1000 y la Loadmaster 3000, dos cargadoras nuevas Chaseside que se están produciendo en la nueva fábrica de Blackburn.

El manipuleo con vehiculos industriales. 4a parte
Por L. F. Hoefkens, A.I.Prod.E. Pág. 37
En esta sección el Sr. Hoefkens se aparta de su criterio acostumbrado de describir vehículos y sus aplicaciones para tratar de la aplicación del estudio del tiempo de trabajo a los vehículos industrialies. Trata este tema detalladamente y lo ilustra con dibujos y un gran diagrama.

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SEVENTH MECHANICAL HANDLING EXHIBITION - 1960

The Seventh Mechanical Handling Exhibition (organized by this journal) will be held at Earls Court, London, from Tuesday, May 3rd, until Friday, May 13th. Make a note.

BULK SALT CARGO HANDLING

By J. M. Beskine, B.Sc.(Eng.)

THIS Mechanical Handling Technical Report deals with a new Crone & Taylor installation of 350 tons/hr handling capacity recently commissioned at the Runcorn Works of Imperial Chemical Industries, Ltd., Salt Division. The new installation is of interest because of its economical design, high productivity, compactness and general adaptability. It supplements a Crone & Taylor warehouse handling system at the same works which incorporates a highly economical shuttle conveyor and thrower system which could well be utilized in boilerhouse bunkers and elsewhere.

Common salt has been manufactured in Cheshire for more than 2,000 years, the semblance of an industrial process having been established by the Romans and continued with but little modification until the end of the nineteenth century when the vacuum process was developed. It was about this time that the idea was born of the present Weston Point Salt Factory, the prime function of which was to produce vacuum salt for export and to utilize its advantageous position on the Manchester Ship Canal to do this cheaply. The object of this new machinery is to replace obsolete equipment which has been in use during the past 50 years and to utilize modern principles of bulk materials handling to improve loading rates and reduce ship turn-round times.

Crone & Taylor (Engineering), Ltd., of Sutton Oak St. Helens, Lancashire, in co-operation with I.C.I., Ltd. Salt Division engineers, have produced a simple, low-cost installation capable of high loading rates, which has many features of interest to those engaged in the broad field of bulk materials handling

It will be appreciated that, despite its apparent simplicity or perhaps because of it, salt is by no means simple to handle economically and on a large and continuous scale. It is highly hygroscopic and corrosive. Damp salt-laden air too, is extremely corrosive. Obviously, when dealing with so 'awkward' a material, economical handling implies far more than satisfactory control and reduction of the mere cost of handling—it means, also, completely trouble-free handling.

Essential Features of the System

Essentially, the new handling system at Runcorn consists of a self-contained compact and highly-mobile high-output bulk

Fig. 1. The s.s. 'Annukka' lying alongside the wharf of the I.C.I. Salt Works, Runcorn, on the Manchester Ship Canal, being loaded with bulk salt by means of the new Crone & Taylor Thrower and Wharf Loader, the boom of which can be seen reaching into the ship amidships

Fig. 2. Close-up view of the Crone & Taylor Thrower and Wharf Loader at work, showing the method of loading salt into the machine's hopper by means of a mobile power shovel, left, and simple method of reaching right into the bottom of the hold

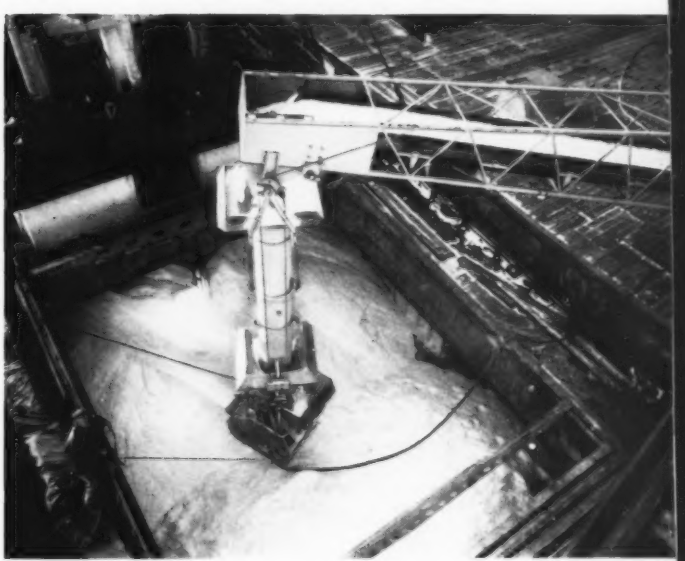


Fig. 3. Looking down into the hold of the s.s. 'Annukka', showing the thrower of the new Crone & Taylor machine, and the method of delivering salt to it by the conveyor boom of the machine

loader and discharger, especially designed to resist corrosion. Output capacity when handling salt is up to 350 tons/hr.

The machine is mounted on wide-gauge tracks to enable it to run up and down alongside the ship being loaded. It is controlled by one man from either of two alternative operating stations. Feeding is by means of 2-cu. yd. capacity loading shovels of the Michigan or Weatherill type, or by 10-ton tipping lorries. The machine is electrically driven and propelled and it is complete with its own large-capacity feed hopper, conveyor belts, chutes, thrower, winching system and turntable system.

Fig. 1 shows a 2,500-ton ship, the *s.s. Annukka*, alongside the I.C.I. salt works wharf, being loaded with bulk salt by the new machine, the conveyor boom of which can be seen reaching into the vessel amidships. Fig. 2 shows a close-up view of the new machine at work, with a mobile power shovel busy keeping the hopper full. Fig. 3 gives a view looking into the hold of the ship, and shows the method of delivering the salt, using a conveyor-fed thrower, which is mounted on a swivelling carriage and easily raised or lowered into the hold of the ship by remote control. The self-contained nature of the new Crone & Taylor machine is shown by the photograph, Fig. 4, and by the layout drawings, Fig. 5. Other photographs show important details of construction and layout.

The superstructure is mainly of tubular steel. This provides a high strength-to-weight ratio and also facilitates protection against corrosion. It will be appreciated that salt is in any case liable to cause corrosion however it is handled and ignoring the use of wood. In a damp atmosphere the corrosive attack upon steelwork is liable to be greatly accelerated, and for this reason special attention was paid to provision of anti-corrosion treatment and to simplification of its maintenance. The use of tubular steel for the superstructure gives a clean and smooth overall surface which does not harbour either salt or rain-water; at the same time it allows a thick protective film to be built up very easily by wrapping with anti-corrosion tapes. Actually, Lanofilm plastic anti-corrosion membranes were used by Crone & Taylor. This material is manufactured by Merseyside Anti-Corrosion Services, Ltd. It is wound round the steelwork, as shown in Figs. 8 and 9, and can be easily renewed, should this prove to be necessary as the result of mechanical damage.

When in operation there appears to be negligible spillage of salt between the tipping lorry or power shovel and the ship, and many visitors have remarked upon the cleanliness of the whole operation.

The most important feature of the new machine, however, is undoubtedly its good adaptability. There seems no reason why such equipment should not be quite easily used on almost any wharf or quay. The arrangement is certainly simpler, and, no doubt, far more economical in first and running costs, than systems using travelling gantry and boom conveyors, etc., as used in typical U.S.A. handling systems designed for similar purposes.

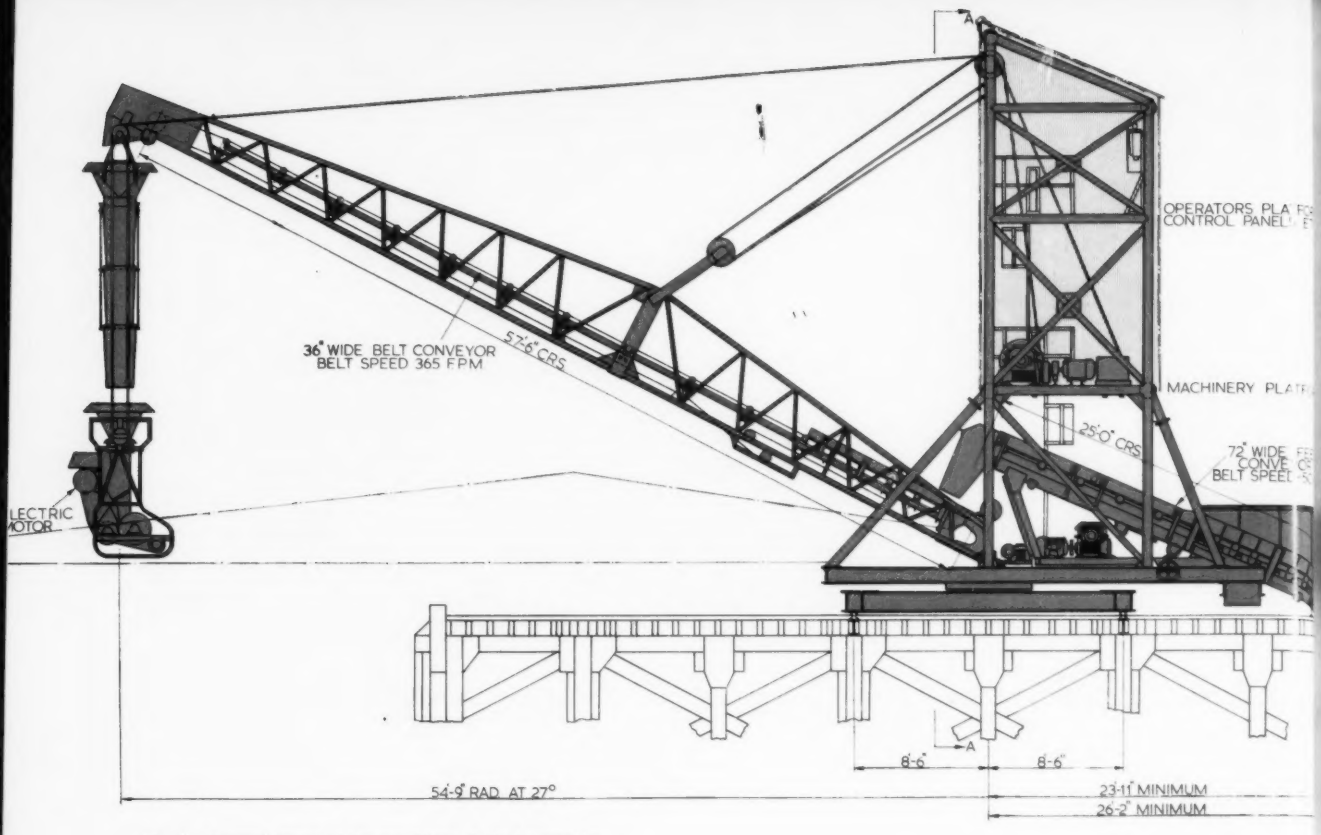


Fig. 5. General layout of the new Crone & Taylor machine

The makers claim the ship loading system enables the storage warehouse or open stock piles to be placed close to the loading point. This implies immediate availability of stored material alongside the ship. By using high-capacity power shovels and tipping lorries, any size of ship can be filled. All this being obtained for relatively low installation costs.

Fig. 4. The new Crone & Taylor machine, prior to commencing work, showing its self-contained layout, method of running alongside the ship by means of travelling wide-gauge rail carriage, large loading hopper, and swivel mounting of the complete machine

Construction and Layout

The new Crone & Taylor ship bulk loader at Runcorn can be considered as consisting of four main units: (a) a feeder; (b) a main conveyor; (c) a thrower, and (d) the superstructure.

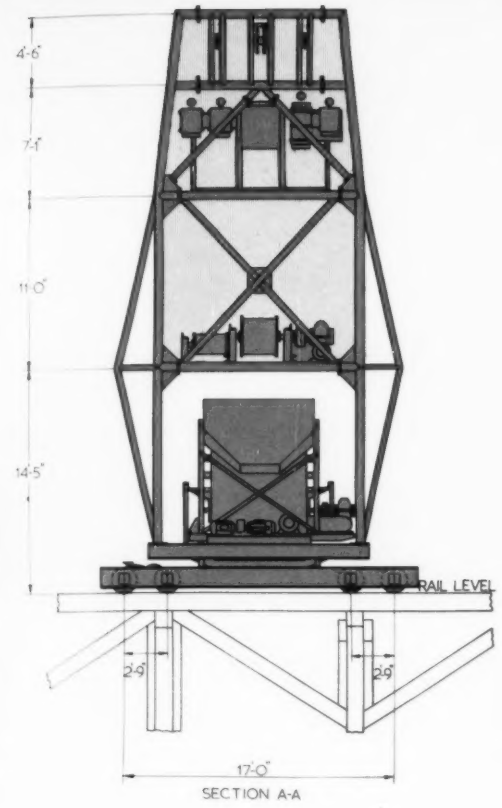
The feeder unit consists of a fixed-inclination troughed belt conveyor complete with loading hopper. This feeder unit is 25 ft long between conveyor drum centres and it discharges the salt through a specially designed hopper on to a 3-ft wide variable-inclination boom conveyor, the main conveyor, as can be seen from Figs. 2, 4, 5, 6 and 7. Retracting gear enables the feeder unit to clear the main conveyor boom when the latter is raised to its maximum height, e.g. when not in use.

The conveyor belt of the feeder unit is 6 ft in width and it consists of 4-ply 28-oz. cotton duck, with a top cover of grade 'A' rubber $\frac{1}{8}$ in thick, and with a bottom cover $\frac{1}{32}$ in thick.

The conveyor runs at 50 ft/min and it is driven by a 15-h.p. electric motor through a Vee-drive and 60:1 ratio fan-cooled worm reduction unit, directly coupled to the shaft of the driving pulley, as shown in Fig. 8.

The feed hopper is 9 ft wide and its general proportions and design can be seen in Figs. 4 and 5. The hopper has an adjustable back plate. This is for use when three power shovels feed the hopper simultaneously, one on each side and a third from the rear.

The main boom conveyor is 58 ft long between drum centres and employs a 36-in wide belt, which may be compared with the much wider feeder belt, the width of which is 72 in. The boom conveyor belt runs at 350 ft/min and is built to the same specification as that used for the feeder conveyor belt. The outlet side of the specially designed hopper which accepts the output of the feeder belt conveyor and discharges it on to the main boom conveyor, is clearly



seen in Fig. 10. The driving unit is shown in Fig. 11 and consists of a 20-h.p. electric motor with Vee-belt drive to a torque arm speed reducer which is mounted directly on the drive pulley shaft.

The main boom conveyor is provided with a rotary nylon brush beneath its delivery pulley to keep salt off the returning length of belt. The boom conveyor structure is of tubular steelwork and encloses the conveyor. The resulting tubular steel-framed boom is carried at its lower end on a shaft supported in bearing blocks and its inclination is controlled by means of a 4-wire hoisting gear, employing 1-in wire rope.

The thrower unit is a Crone & Taylor suspended Meteor thrower, one of a range of Crone & Taylor machines built mainly for use as ships' trimmers. Such a machine, when suspended from a ship's fall or boom conveyor, can fill the hold of the ship in question right up to deck level. For use on land, such a machine can fill a warehouse right up to roof level. It can even double existing stockpiles when fitted to the delivery end of a stacking conveyor. Brief details of standard Crone & Taylor Meteor throwers are given in the short digression which follows.

Meteor Thrower Output

Crone & Taylor suspended Meteor throwers are provided with fixed angle output chutes, but can be provided with low-trajectory output chutes for use when trimming a ship, or with high-angle trajectory output chutes for use when stockpiling.

Alternatively, machines may be provided with height adjusting gear. Variable speed gear enables greater flexibility to be obtained when operating in confined spaces, and complete flexibility is obtained by incorporating both variable speed and discharge angle adjustment controls. These refinements are of some importance when handling materials liable to damage if handled at too high a velocity. Standard machines can be provided with remote control

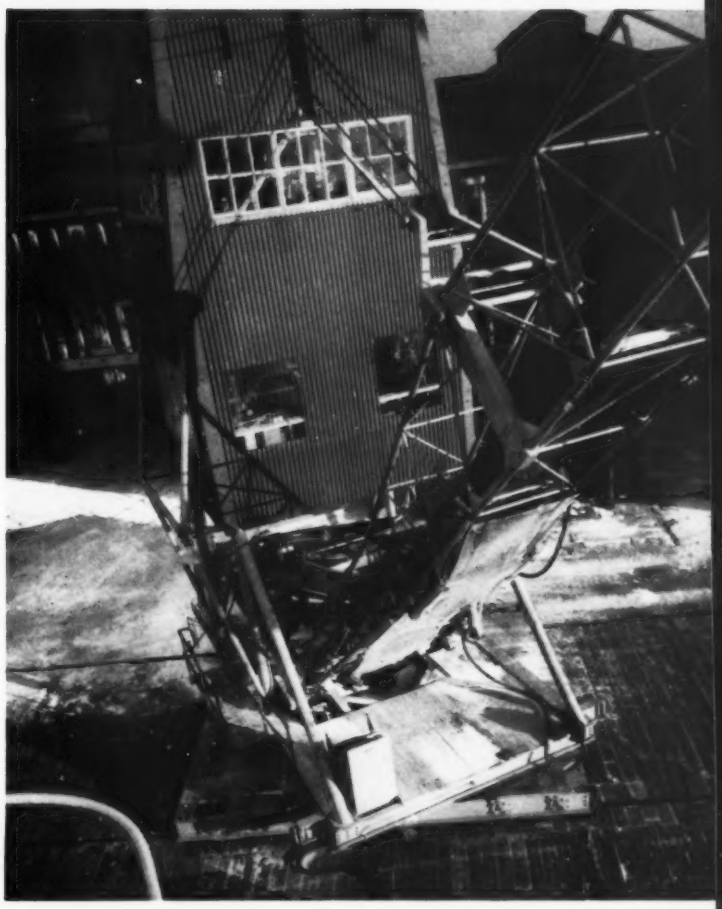
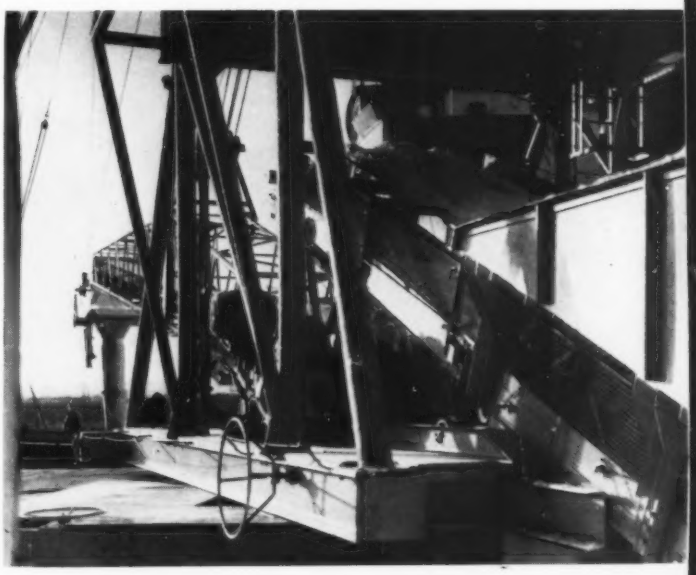
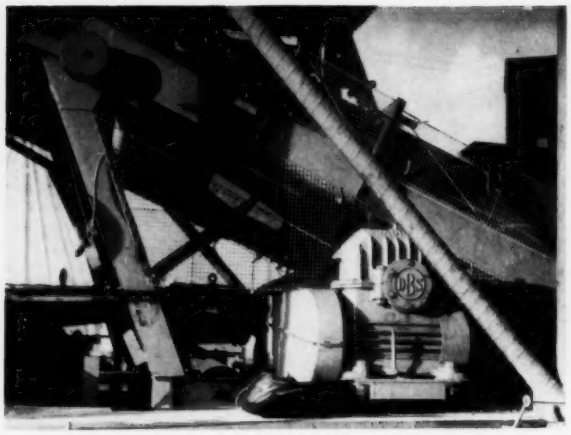


Fig. 7. View of root pivot of boom conveyor of the new machine, with upper control room inside top level window of superstructure housing. Note cable control of boom inclination and turntable mounting of machine as a whole, on wide-gauge rail carriage

Fig. 6. Salt being loaded on to the boom conveyor of the new machine from the feeder conveyor, right. Note tubular steelwork of superstructure





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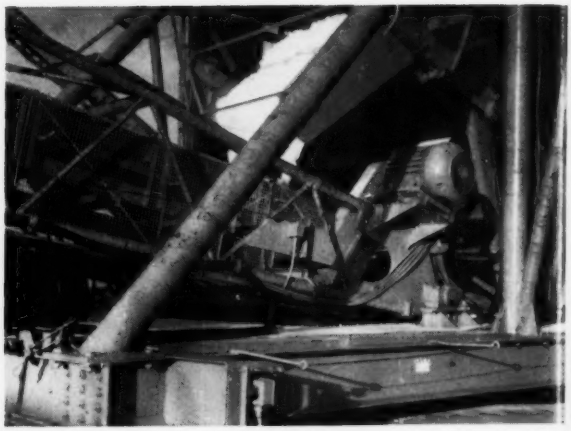

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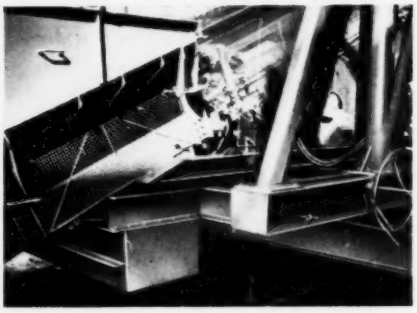

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Fig. 8. Drive unit of 6-ft wide feeder conveyor. Note Lanofilm anti-corrosion taping on tubular steelwork of superstructure

Fig. 9. Constructional detail, showing part of feed-hopper end of feeder conveyor. Note Lanofilm-protected tubular steelwork

Fig. 10. Salt pouring on to the main boom conveyor of the new machine when loading a ship, showing the full-bore outlet of the loading between feeder conveyor and main conveyor. Note also the two-storey superstructure with a control cabin on the top level and motor and winch house at the lower level

Fig. 11. Drive unit of the main boom conveyor located at the feed end of the conveyor. Note steelwork taped with corrosion-resisting tape, finished with paint

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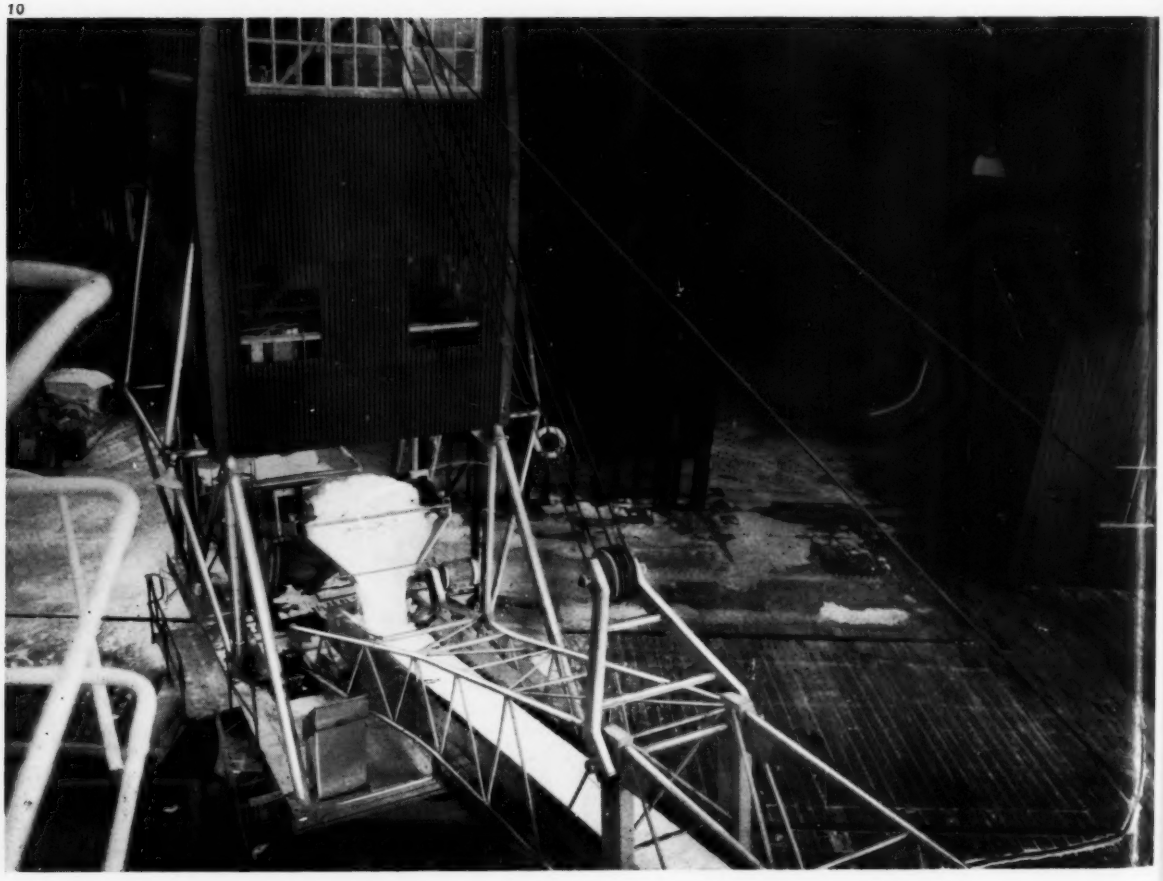

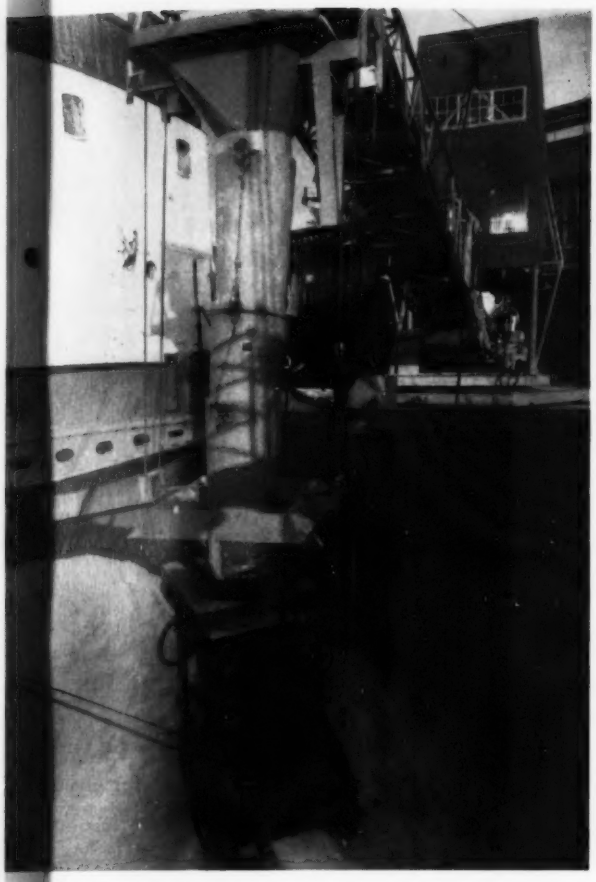

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12

14A

Fig. 12. *Thrower unit of the new machine suspended inside a ship's hold and working at full bore. Note turntable fixture enabling thrower to swing through* 360 *deg*

Fig. 13. *Method of supporting thrower from end of boom is clearly shown in this illustration. Note also resin-bonded glass chutes and wire rope depth control mechanism*

Fig. 14*a*. *Close-up view of thrower unit chutes and wire rope depth control*

Fig. 14*b*. *Close-up view of thrower unit commencing work in an empty hold*

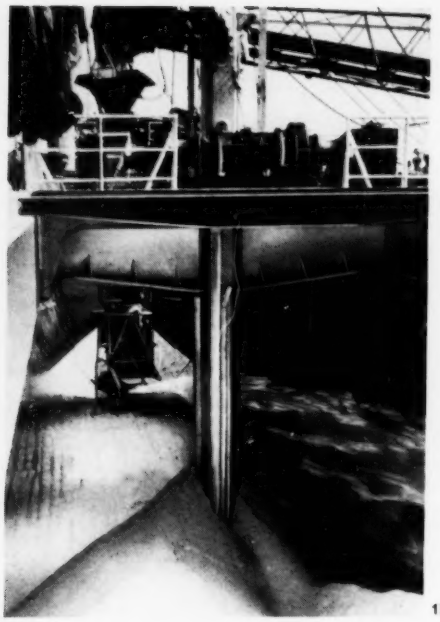
for rotation or hoisting, and installations can be supplied complete with deck-mouting starters and generating sets. Typical output capacities are as follows:—

Output capacities of standard Crone & Taylor suspended Meteor throwers

Belt	Capacity *
12 in	80/100 tons/hr
18 in	150/180 tons/hr
24 in	250/280 tons/hr
30 in	350/400 tons/hr
36 in	450/500 tons/hr
42 in	550/600 tons/hr

* When handling sugar

14B



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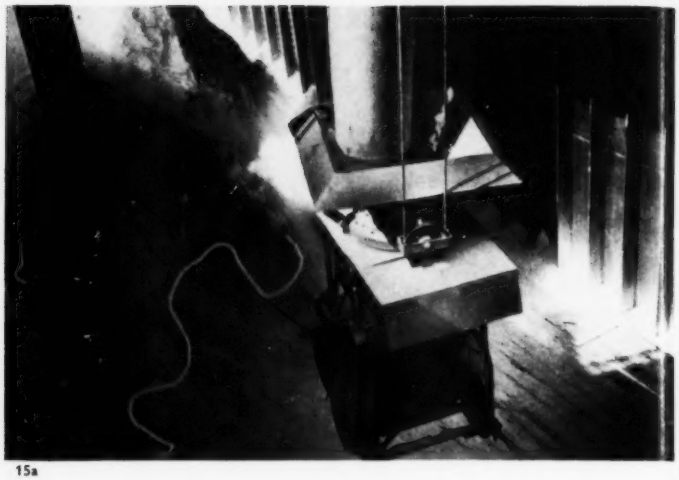


15a

Fig. 15a. Another view of the thrower unit hard at work in a hold

Fig. 15b. This photograph shows the ability of the thrower unit to reach points between deck openings

Design of Thrower

The thrower unit used at the Runcorn installation has a 30-in belt of special transmission duck, manufactured endless and running at a high speed. The thrower has a maximum throw of 60 ft. It is driven by a powerful electric motor with Vee-belt transmission and is provided with three tapered cylindrical chutes, and with a concentrating hopper on the conveyor jib. There is also a polyester resin-bonded glass-fibre feed hopper on the thrower frame. This hopper directs the salt from the conveyor delivery pulley to the thrower belt.

A by-pass is incorporated in the feed hopper. This has a thrust-operated flap valve, which is electrically connected with the thrower motor, so that when salt is not required to pass through the thrower, the by-pass is automatically opened.

The frame is principally of tubular steelwork and it is suspended from the end of the conveyor jib by two wire ropes. A small ball-bearing type turntable ring is incorporated, permitting 360-deg. rotation of the thrower unit, thus enabling all parts of ships holds to be reached.

The general layout of the thrower unit is shown in Fig. 5. Interesting details of construction are shown in the photographs. Fig. 3 shows the thrower unit shortly before completion of loading. A close-up view of the thrower unit at work is shown in Fig. 13, and Fig. 14 shows the thrower at commencement of loading, with the hold empty. The ability of the thrower to load cargo between easily reached parts of adjacent hold compartments, is shown in Fig. 15. A close-up view of the resin-bonded glass-fibre feed hopper is shown in Fig. 14. The two-wire suspension system is indicated in Fig. 15, and Fig. 16 shows the thrower unit resting on the wharf, as when not in use.

General Design and Construction

Generally, the mechanical design includes refinements to enhance safety and improve resistance against corrosion. For example, great attention has been paid to safety requirements throughout design, British Standard BS 2890 being used as a basis for this purpose. Fig. 17 shows one of the safety features provided, a rope-operated safety-switch system, which runs alongside the conveyors and enables instantaneous shut-off to be achieved from any point alongside. Examination of the photographs will show another feature, fully-guarded conveyor drives and 'belt nips'.

All modern anti-corrosion measures have been applied throughout design and construction. The conveyor idlers, for example, are of grit proof sealed ball-bearing type, and they are vitreous enamelled for corrosion resistance.

The use of special adhesive anti-corrosion tape for protection of the tubular steelwork has already been briefly described. Prior to taping the steelwork was painted with red lead, and after taping, finishing coats of paint were applied. The other steelwork was provided with a red lead primer over which was applied two coats of I.C.I. Paints' Division anti-rust protection, rubber wax paint. This in turn was overpainted with *Dulux* gloss finish.

The Structure

The structure consists of five main components, as follows: (*a*) the main carriage and traverse gear, (b) the turntable and slewing mechanism, (c) the superstructure, (d) the hoist drive units, and (e) the control platform.

The main carriage is of steel joist and channel construction and incorporates four double-wheel bogies, two pairs of which are driven through reduction gearing by a 10 h.p. electric motor, giving a traverse speed of 34 ft/min.

The turntable and slewing mechanism employs a 5 ft 6 in dia combined direct thrust/radial load turntable ring of the precision ball-bearing type. This is mounted at the centre of the main carriage and it carries the top frame, which can be rotated through an arc of 300 deg by means of a 3 h.p. electric motor working through a reduction train.

Heavy-gauge steel tubes are used as principal members of the superstructure. Two principal intermediate platforms are incorporated, one of which carries the main jib hoist and thrower hoist drives, and the other carries the central control platform. The superstructure is sheeted with *Coroplast* corrugated sheeting with opening windows and dead lights. Interior lighting is provided to enable the machine to be controlled after dark.

The driving gears for the main jib and for the thrower are mounted on the lower of the two platforms of the superstructure. These incorporate electro-magnetic brakes fitted with double springs and limit switches etc.

The upper platform of the superstructure carries the

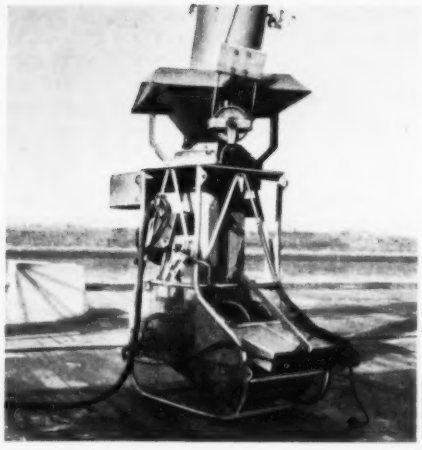


Fig. 16a. (*Right*) *Moving the suspended thrower unit into a ship's hold prior to loading*

Fig. 16b. (*Above*) *The thrower unit on the wharf, when not in use*

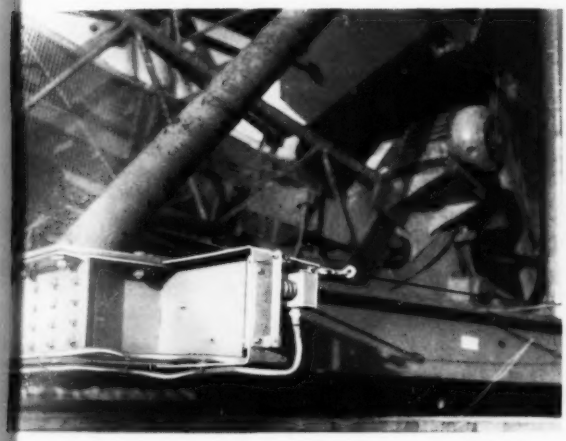


Fig. 17. (*Above*) *Close-up view of rope-operated safety switch*

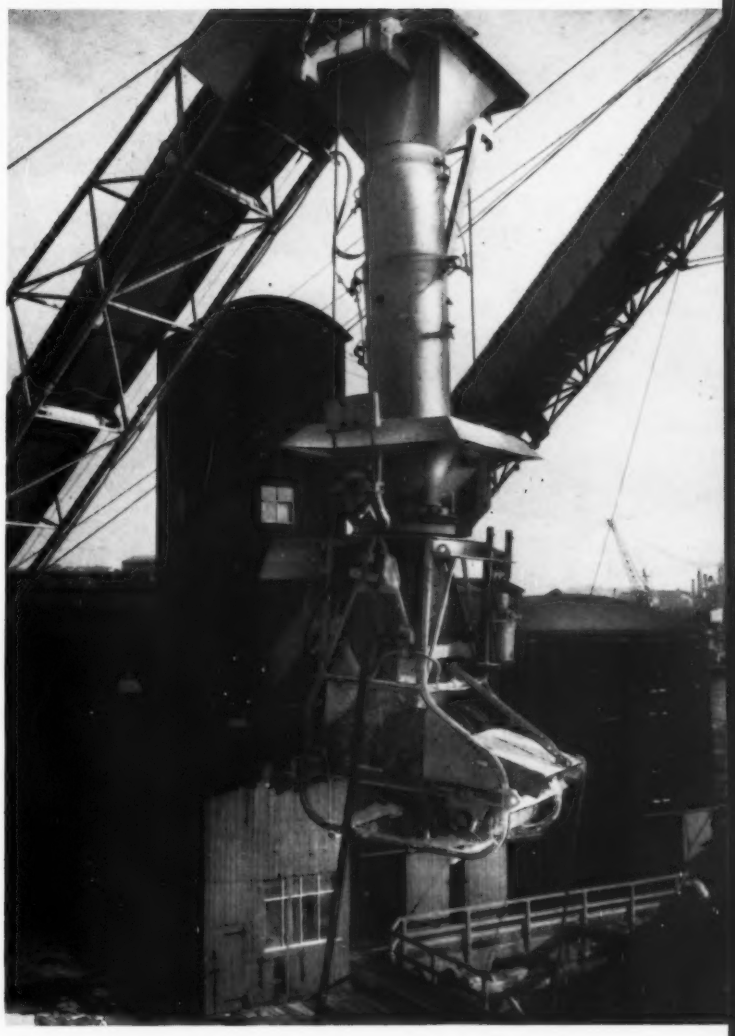


Fig. 18. New remote-control station on rotating base of the machine. Top controls are for traverse, thrower hoist, main conveyor and feeder conveyor. Bottom controls are for rotation, jib luffing, thrower operation and all plant stop (*Below left*)

Fig. 19. View of winch floor in superstructure, showing special protective coats on the electric motors (*Below*)

individual motor starters, arranged to permit either local control or remote control from a control panel on the upper part of the machine. This is the normal operating position of the machine and the operator is able to see right round his machine and well into the hold of the ship being loaded.

A second remote-control panel has also been installed, at ground level, as shown in Fig. 18. This is on the rotating base of the machine and it enables the operator to control the machine without climbing up into the top control cabin, which has its disadvantages when working along a ship. The controls shown in Fig. 18 are as follows: top left to top right, traverse, thrower hoist, main conveyor, feeder conveyor; bottom left to bottom right, rotation, jib luffing, thrower, and all plant stop!

Electrical Features

All electrical gear is enclosed in heavy-duty cast-iron weatherproof-pattern enclosures, in order to withstand the severe operating conditions likely to be encountered, and all motors are covered with protective coats of fabric as shown in Fig. 19.

To prevent the feeding of material on to a stationary conveyor belt electrical sequence control is used. And, throughout, PVC-insulated single-wire armoured and PVC-sheathed overall cables have been used for the interwiring of the main, the auxiliary and the control circuits. The whole machine is fed with electric power through a single pliable armoured cable, power being obtainable from any one of four outlet socket points along the wharf. In all about 1,350 yd of cable was used, the wiring sub-contractor being S. H. Heywood & Co., Ltd.

Electrical safety is catered for by providing a proved earth system. In view of the mobility of the equipment, and because of the extremely corrosive operating environment, it was considered necessary to incorporate a monitored-earth system. All parts of the machine, including the suspended thrower, are protected, earth continuity being constantly checked from four relay points incorporated in each of the main-power sockets. These power sockets are mounted in timber cubicles fitted with low-powered heaters to prevent electrical troubles due to condensation.

The ancillary equipment is provided with direct push-controlled stop switches, and rope-operated switches are used to give a ready and instant means of stopping moving belts or rotation or traverse movements. A typical example is shown in Fig. 17. Such devices, i.e. push switches and rope-pull switches, are fitted at all points where an operator could become trapped. In addition, a Klaxon horn is fitted to give audible warning before any of the equipment is set into motion.

Assessment

In this case, comments and opinions would appear to be superfluous. The facts speak for themselves. The new Crone & Taylor ship-loading machine is not a revolutionary departure. It is not something untried or unusual. It is simplicity itself, being based upon integrated design and construction of well-proven principles—the use of throwers, troughed belts, loading hoppers, centralized control, lightweight tubular steelwork, rail traversing, and ultra-modern turntable contruction. The point is that these have been combined into a very efficient and workable unity.

The specification details given above are somewhat curtailed in order to avoid describing in detail special design aspects which are best considered as part of Crone & Taylor 'know how'. However, they indicate quite well the sound construction and practical handling experience built into the new machine. These make it compact, clean in operation, economically designed, adaptable, flexible, and in many ways worth considering when dealing with ship bulk-loading problems in general, especially when it is desirable to achieve top performance without excessive expenditure of time and money, particularly, too, where it is desired to get maximum output from existing wharves and thus to avoid heavy wharf reconstruction costs.

VISIT OF JAPANESE MATERIALS HANDLING STUDY TEAM

LEFT: *Mr. Teizo Sohma, Team Leader and Secretary of the Japanese Materials Handling Study Team, signing the Deed of Affiliation between the Japanese Society and the British Institute of Materials Handling; also in the picture is Mr. Charles Remfry, National Chairman of the Institute of Materials Handling*

BELOW: *Mr. Charles Remfry, National Chairman of the Institute of Materials Handling, introducing the Japanese team to members of the British Institute*

As announced in recent issues of *Mechanical Handling*, the Japanese Materials Handling Study Team duly arrived in this country as part of their six-week tour of Europe, designed to study materials handling in the production of a wide variety of products. The accompanying illustrations show the signing of the affiliation of the Japanese Society and the British Institute of Materials Handling. They also visited Birmingham during their stay and a cocktail reception was given in their honour at the Queens Hotel.

Opening of a new Depot at Low Fell, Newcastle

HANDLING TECHNIQUES IN BRITISH ROAD SERVICES

By a Special Correspondent

Fig. 1. Aerial view of Low Fell B.R.S. Depot

BRITISH ROAD SERVICES' latest major depot at Low Fell, Newcastle, formally opened by Sir Brian Robertson, Bt., G.C.B., G.B.E., etc., chairman of the British Transport Commission, covers some 17 acres and caters for the parcels, general haulage and warehousing activities of British Road Services on Tyneside. It incorporates the latest thoughts within B.R.S. on handling techniques. In addition to those parts of the depot operated by B.R.S. themselves, the site includes a warehouse leased to and worked by J. H. Heinz, Ltd.

The transit shed proper has a total area of 88,000 sq. ft., and is divided into two portions. The south portion is allocated to parcels operations and the north to general haulage. The main warehouse, 'B', operated by B.R.S. themselves, stretches along the whole of the east side of the transit shed, giving ready access to both the parcels and general haulage sections. Warehouse 'A', leased to H. J. Heinz, Ltd., is a separate building to the north of the main shed.

Parcels Operations

The handling methods employed in the parcels shed are a radical departure from previous practice, following a pilot scheme at a smaller depot in Dundee. In an orthodox parcels depot, a single island platform is normally provided some 50 ft wide, to both sides of which vehicles back up for unloading and loading and on which the parcels are sorted and stacked where necessary to await re-loading. In most depots of this type handling operations are manual, porters using two-wheeled sack trucks supplemented by four-wheeled trolleys or semi-live stillages and tug bars.

At Low Fell there are two parallel platforms, respectively 8 ft and 12 ft wide, to the outer faces only of which vehicles back up for unloading and re-loading. The sorting and stacking of traffic is carried out at floor level in the space between the platforms.

The difference in levels of 3½ ft between the unloading platform at the west side of the shed and the central floor area is utilized to move incoming goods from road or rail vehicles by gravity roller conveyor. To enable the direct discharge of parcels traffic trunked by rail, a rail siding runs along the west side of the parcels transit shed. Four parallel unloading trains of roller conveyor project into the depot from the unloading platform at a falling gradient of approximately 1 in 11. On both sides of the rollers, eight 40 × 60-in box pallets are placed with their open sides facing the conveyor. Each of these pallets corresponds to an outward trunk or delivery vehicle route or to a 'secondary sorting area'. Flat pallets for awkward items of traffic are positioned on the unloading platform itself—for goods that will not safely pass over the rollers—and at the end of the conveyor for traffic which will not fit economically in box pallets, or which is difficult to lift from the conveyor to the pallets on either side of it. The roller conveyor trains can be extended across the platform into the vehicles being unloaded.

Pallets for traffic which has received its final sort to outward route at the unloading rollers are moved by fork truck directly to the outward vehicle if the latter is ready for loading. If loading is not yet ready to commence, the pallets are stacked up to four high, 16 ft in all, in a temporary buffer allocated to the route concerned.

As B.R.S. (Parcels), Ltd., operate between 30 and 40 delivery rounds from Low Fell depot, it is difficult to give a direct sort to outward route at the unloading rollers for every round. Traffic for certain delivery rounds therefore receives the final sort in secondary sorting areas located between unloading and loading platforms. Packages for any of the rounds served by a given secondary sorting area are transferred from the unloading roller conveyor into the box pallet allocated to that area which is then moved by fork truck to the west end of the area concerned. The pallet is then perambulated by hand pallet truck and the packages are transferred into further box pallets corresponding to the delivery round. As the delivery round pallets are filled in this way, they are stacked by fork truck in small buffers on the edge of the secondary sorting area until the outward vehicle is ready to be loaded. Should loading operations already be under way, the filled pallets are taken immediately to the loading platform, buffering only being carried out when necessary.

During loading operations, fork trucks shuttle between the pallet buffers of sorted traffic, the secondary sorting areas and the unloading roller trains and the vehicle loading

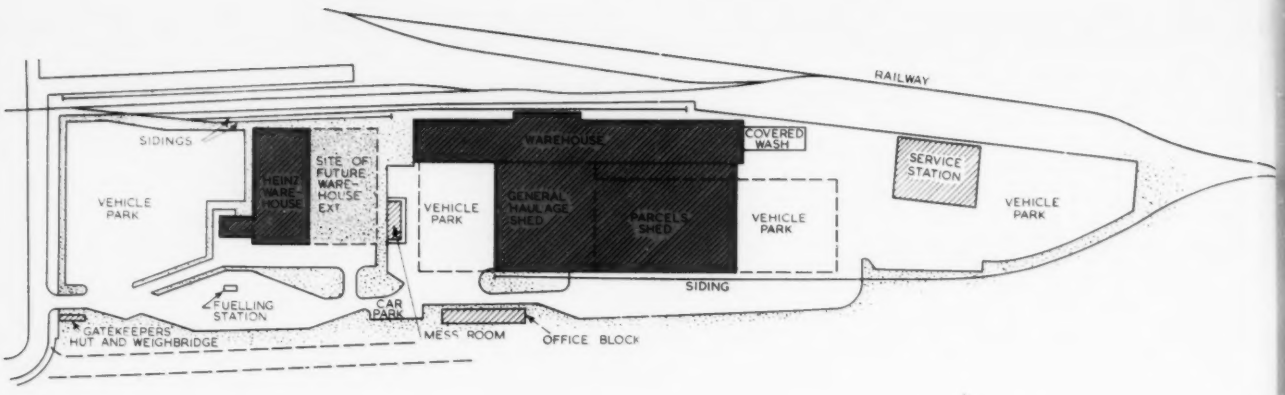


Fig. 2. Plan of depot and ancillary installations

positions carrying pallets filled with traffic in one direction and returning with replacement empties. In general there should at any one time be two pallets behind a vehicle that is being loaded available to the loading crew for stowing. As each pallet is emptied, the loading team passes on to the second pallet while the first is replaced by a further full one from the unloading trains or the secondary sorting area.

Throughout, palletization on the vehicles themselves is at present confined to a smaller number of traffic flows of suitable goods which are palletized in special pallets at the premises of the sender. The throughout palletization of miscellaneous parcels traffic is not at present economical as the payload of the trunk vehicle is severely reduced even with the 40 × 60-in box pallets used by B.R.S. (Parcels), Ltd., for domestic purposes. Active research is, however, continuing into the economics of a much larger pallet—virtually an openwork container with a palletized base—as it is considered by the B.R.S. headquarters that the full financial benefits of palletized working in parcels sheds cannot be gained unless the traffic can be palletized on inter-depot trunk runs as well as domestically in the shed operations.

Four-thousand-pound-capacity diesel fork trucks are standard for palletized shed operations within B.R.S. (Parcels), Ltd., the establishment at Low Fell being five. These fork trucks must comply with a standard B.R.S. specification which includes a rating under certain conditions of 2,800 lb at 30-in centres, a maximum overall width of 40 in and a maximum overall length of 10 ft 6 in.

Two types of B.R.S. standard pallets are employed in domestic operations in parcels sheds, each with a plan dimension of 40 × 60 in.

The first type, known as S.P.S.2, is a tubular steel frame box pallet with mesh filling to three sides and a 16-gauge sheet steel deck. In current versions, the fourth side is left

Fig. 3. North face of general haulage platform showing miscellaneous traffic stacked on 40 × 60-in S.P.S.3. gondola pallets awaiting reloading for radial distribution

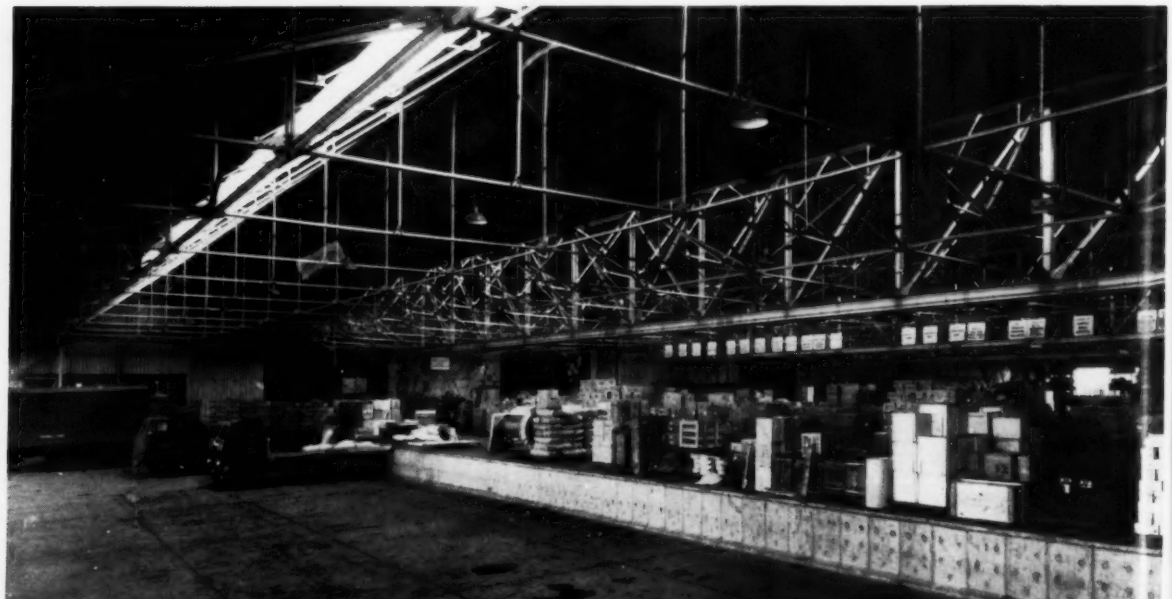


Fig. 4. General view of secondary sorting area where local traffic is sorted into box pallets corresponding to delivery rounds. In the foreground an awkward-package park

open, the removable gate fitted to early designs having been found to be superfluous for shed working. An unusual feature of the design is that while cup-shaped feet are provided for stacking purposes these are inverted and fitted to the top four corners of the pallet, where they receive the legs of superimposed pallets. These legs do not touch the ground as when a pallet is resting on the floor or on a vehicle platform it stands on parallel skids inset from the 60-in sides. This feature can be seen in the pallets illustrated in Fig. 4.

The second type of parcels pallet is flat and is known as a 'gondola', or officially S.P.S.3. The undercarriage of the pallet is generally similar to the S.P.S.2 box pallet, including truncated legs to enable it to be stacked on top of a box pallet. The sheet steel deck is, however, not completely flat as in the S.P.S.2., but is uptilted about ¼ in each end to lend stability to miscellaneous traffic. It is this feature from which it derives its unofficial name 'gondola'.

These flat pallets are required mainly for awkward items of traffic which are the bane of any mechanical handling scheme for a parcels or sundries shed. At Low Fell, awkward packages are separated from the general stream of parcels at the unloading platform and are transferred to awkward-package parks from which they are drawn for outward loading as required. Awkward packages represent approximately 5 per cent of the total of 55,000 items a week which pass through the parcels section of the Low Fell shed. Some of these are impossible to handle even on a flat pallet and have to be moved either directly on the forks of a fork truck or, as a last resort, manually.

The stock of steel box and flat pallets required for domestic working in the Low Fell parcels shed is approximately 700.

General Haulage

Handling in the general haulage section at the north end of the transit shed falls into two main categories—transhipment and radial distribution ex warehouse.

General transhipment in the yard is carried out by a 6/8-ton Shelvoke & Drewry fork truck/crane equipped with interchangeable forks and jib. This machine can also operate within the transit shed as necessary, as the clearance to the roof trusses is 20 ft.

Radial distribution of goods stored in bulk in the warehouse is a rather more complicated affair and for that purpose the general haulage shed contains a 60-ft-wide loading bank running from east to west on the same level as Warehouse 'B'. Two electric 1-ton pallet trucks operate on the bank and between the bank and the warehouse in conjunction with a further supply of steel S.P.S.2. gondola pallets on which the traffic is held temporarily on the platform in the vicinity of the outward rollers concerned. When traffic is to be outward loaded from the warehouse in bulk, full pallet loads are moved from the warehouse to the loading platform on wooden warehouse pallets by the general haulage shed electric pallet trucks or by the warehouse fork trucks.

Warehouse 'B'

Warehouse 'B' adjoins the parcels and general haulage transit sheds and is 600 ft long with a volume of 900,000 cu. ft. It is the largest palletized warehouse at present operated by British Road Services. The warehouse is

Fig. 5. Palletized traffic being unloaded into Warehouse 'B' from the rail siding by a 2-ton capacity electric reach truck

divided into three bays by fire break walls with openings and has a 17 ft 6 in clearance to the tie bars to enable goods to be stacked to a height of 16 ft. The B.R.S. standard gross height of a pallet load in a warehouse is 4 ft so that four pallets can be tiered in a stack within the warehouse. When operations first commenced, the warehouse was planned for operation by normal cantilever fork trucks working in 12-ft gangways. Pressure of work has, however, caused a revision of the original plan in order to find room for an additional 25 per cent of goods and the warehouse is now in process of conversion to reach-truck working in 8-ft gangways. Eventually three 2-ton reach trucks will be provided to take the place of the two 2-ton cantilever fork trucks originally supplied.

Some idea of the complexity of transit warehousing may be gained from the fact that around 1,000 different lines of goods are warehoused at Low Fell, each of which needs ready access for radial distribution. Goods for storage are in general, received in bulk and distributed piecemeal against customers' orders. Individual orders may, for example, be as small as half a dozen bottles of fruit sauce. To facilitate order picking of these small lots, pallet converters, which take the weight of superimposed pallets off the goods themselves, are fitted to the bottom pallets of many pallet stacks so that individual cartons or outers can be extracted without disturbance to the stack as a whole. These pallet converters are also found valuable in the storage of goods particularly susceptible to crushing.

In the light of experience gained during the past year pallet racks are shortly to be installed in the centre bay of Warehouse 'B'.

A railway siding runs along the whole of the east side of Warehouse 'B' and certain streams of traffic are received into the warehouse by rail.

A stock of some 4,000 40 × 48-in B.R.S. standard S.P.S.1 wooden warehouse pallets is maintained, this size having been found the most suitable for many varieties of traffic which require to be stored. These S.P.S.1 pallets are standard for most B.R.S. palletized warehouses. They are

Fig. 6. General view of Warehouse 'B' showing cartoned traffic stacked on B.R.S. standard 40 in × 48-in S.P.S.1. warehouse pallets. The pallet converters to be seen on the right are used to facilitate small order picking

Fig. 7. Warehouse 'A' which is leased to and operated by a customer of B.R.S.

two-way entry, made of softwood and have a bottom deck which gives a bearing surface equal to 40 per cent of the nominal plan area. The two-way entry design was selected in view of its simplicity and low maintenance cost. S.P.S.1. pallets are made in three designs, respectively for normal packages, small packages and reversible.

Warehouse 'A'

This is a smaller building as you go toward the north end of the site and is operated by H. J. Heinz, Ltd., with their own pallets and electric fork truck. Low Fell provides, therefore, instances of both types of transit buffer warehousing which are part of the services which B.R.S. offers to industry. On the one hand goods can be stored in a warehouse staffed and operated by B.R.S. On the other hand, a complete warehouse can be leased to a manufacturer for operation by his own staff and equipment. In each case the warehouse complies with the B.R.S. standards of either 17 ft 6 in or 20 ft clearance to roof tie bars and to a lateral module of 66 ft to permit the working by either cantilever or reach fork trucks. The railway siding along the east side of Warehouse 'B' extends to Warehouse 'A' also to enable rail access to this warehouse.

Ancillary Services

Devotion to detail in handling matters is also evident in the ancillary services of Low Fell depot. In the service station, exterior doors are power operated to avoid unnecessary manual work and to conserve the interior heating. The servicing equipment within the station also includes a number of modern labour-saving devices.

The fuel island near the north end of the depot is equipped with 15 serving hoses for fuel and lubricants, all of which are remotely controlled from an operating cabin on the centre of the island. By push-button operation the exact quantity of fuel or lubricant is dispensed to the vehicle which requires it by a single operator. Documentation of fuel issues is automatically carried out at the same time.

Handling Equipment

This was provided by the following suppliers:—

Type of Equipment	*Suppliers*
Diesel fork trucks	Shelvoke & Drewry, Ltd.
	Caledonian Tractor & Equipment Co., Ltd. (Hyster Agents)
	Coventry Climax Engines, Ltd.
Electric fork trucks	Conveyancer Fork Trucks, Ltd.
	Lansing Bagnall, Ltd. (Reach Trucks)
	Yale & Towne Manufacturing Co. (For H. J. Heinz Warehouse 'A')
Electric pallet trucks and hand pallet trucks	Yale & Towne Manufacturing Co.
Wooden S.P.S.1. pallets and pallet converters	W. C. Youngman, Ltd.
Steel box and flat pallets	Tubewrights, Ltd.
Roller conveyors	J. Collis & Sons, Ltd.
Service station equipment	Laycock Engineering Co., Ltd.
Power-operated doors	Potter Rax, Ltd.

Conclusion

In his inaugural address, Sir Brian Robertson stressed that from the point of view of handling, Low Fell was to a considerable extent a test bed. Several of the methods employed there were still in the experimental stage and might well be modified when applied elsewhere. Perambulation of pallets by pallet truck in the parcels secondary sorting area is, for example, to be replaced in the next major parcels depot at Liverpool by roller conveyors which will be used to carry out the final sort for outwards traffic in the same way as the primary sort is made at Low Fell.

Whatever modifications are eventually required in detail, it is evident that British Road Services must be regarded as amongst the most forward-thinking operators in this country where mechanical handling is concerned. To quote the words of Mr. T. G. Gibb, General Manager of British Road Services, 'The opening of the Low Fell depot marks an historical point in the development of handling in road transport', which would not have been possible without the opportunities for operational research provided by a large organization.

Fig. 8. Fuel handling. The issue of fuel and lubricants to vehicles is centrally controlled by push-button from this control cabin on the fuel island

FACTORY LAYOUT PLANNING*

By L. W. Bailey, F.R.Econ.S., A.M.I.Prod.E.

ANY MANUFACTURING establishment, if it is to be successful, must be organized to pursue some recognizable purpose. In the broadest sense it might be said that the purpose of industry is to produce 'those goods and services that the community needs' and since we live in a competitive society, that end must be achieved in the most economic manner possible.

It is important to underline the word economic because a great many of our decisions in industry need to be based upon an assessment of whether one course of action or some other achieves more or less, in economic terms, in relation to our purpose. To be successful, therefore, any manufacturing establishment must make the best use of all the resources employed in the enterprise. These resources are: 1. buildings; 2. plant and equipment; 3. manpower; 4. materials; 5. finance; 6. management.

These resources are, of course, all related and interdependent and, moreover, limited in their availability at any point in time. Management's task, in these circumstances, is to maintain a proper balance in the operation of these resources through the means of planning, co-ordination, motivation and control.

Any factory is a link in an extended chain of activities that starts with the winning of the basic raw materials from their natural sources and ends with the delivery of the product to the ultimate consumer. Thus, the factory may be seen to be part of a continuous flow whatever its location in the chain may be. In general, the longer this chain, in terms of processes and time, the greater the accumulated costs. The principle aim, therefore, of a good layout should be:

'To permit the quickest flow of materials at the lowest cost and with the least amount of handling in processing the product from the receipt of the raw material to the despatch of the finished product'.

If you consider this aim for a moment you will appreciate that it applies not only to the layout of the factory as a whole but also to any section within the factory, since each will receive materials from somewhere, carry out some process or processes on it, and despatch it elsewhere.

This principle holds good whatever the nature of the processes carried out, whether they be: 1. Continuous—as in refining, flour milling, etc.; 2. Repetitive—such as in the mass production of motor cars, washing machines, etc.; 3. Intermittent—such as heavy electrical or mechanical engineering.

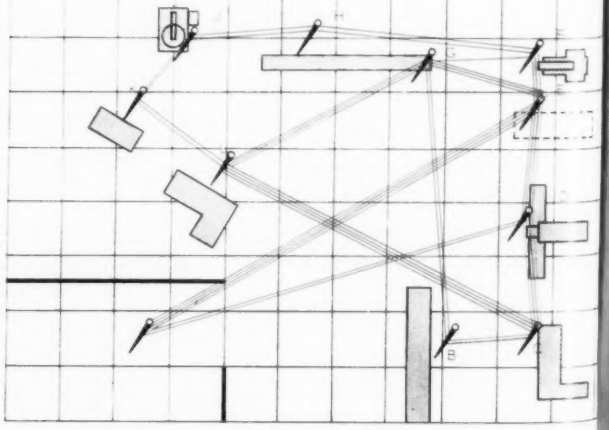
While the purpose of the layout will remain the same, its arrangement will be very greatly influenced by the nature of the processes, the basis on which production is organized and by the characteristics of the products themselves, as well as by a great many other factors. The subject of layout is very broad indeed; it bears upon every industrial activity whatever the size of the organization concerned or the product that is manufactured. It enters also into the organization of many other activities even when the end product is not a manufactured commodity but is a service, such as, for example, clerical work, banking, shopkeeping, stores and warehousing.

In my own organization we have worked on layout projects ranging from planning a small repair shop for farm implements to the organization of an oil refinery warehouse providing every need of a whole community in the Middle East. In terms of products, our assignments on layout have covered domestic brushes, pottery, office appliances, paper and books, furniture, and many others beside. I intend, however, to confine my observations to the kind of problems likely to be encountered in a manufacturing establishment operating on the basis of what is usually termed batch production.

In so doing I think I will be dealing with the kind of organization with which most of you will be familiar, since batch production is by far the commonest form of organization in the commodity manufacturing industries, whatever the product. Having set my limits, let me now describe the general case applicable in most circumstances and whilst I do so I'll mention some of the layout problems that arise.

First of all, materials will arrive at the factory in bulk quantities, at intermittent intervals, at times that are not precisely predictable. They must be unloaded, checked and inspected and then passed to the custody of the stores, pending issue to production. Here, right at the start, we meet

Fig. 1. Example of a string diagram showing operator's travel between 11 process/storage points. It gives visual appreciation of the incidence of movement between the related work stations and provides a means of measuring distances covered in a specified operational work cycle



*A paper read before the North Hertfordshire Productivity Council.

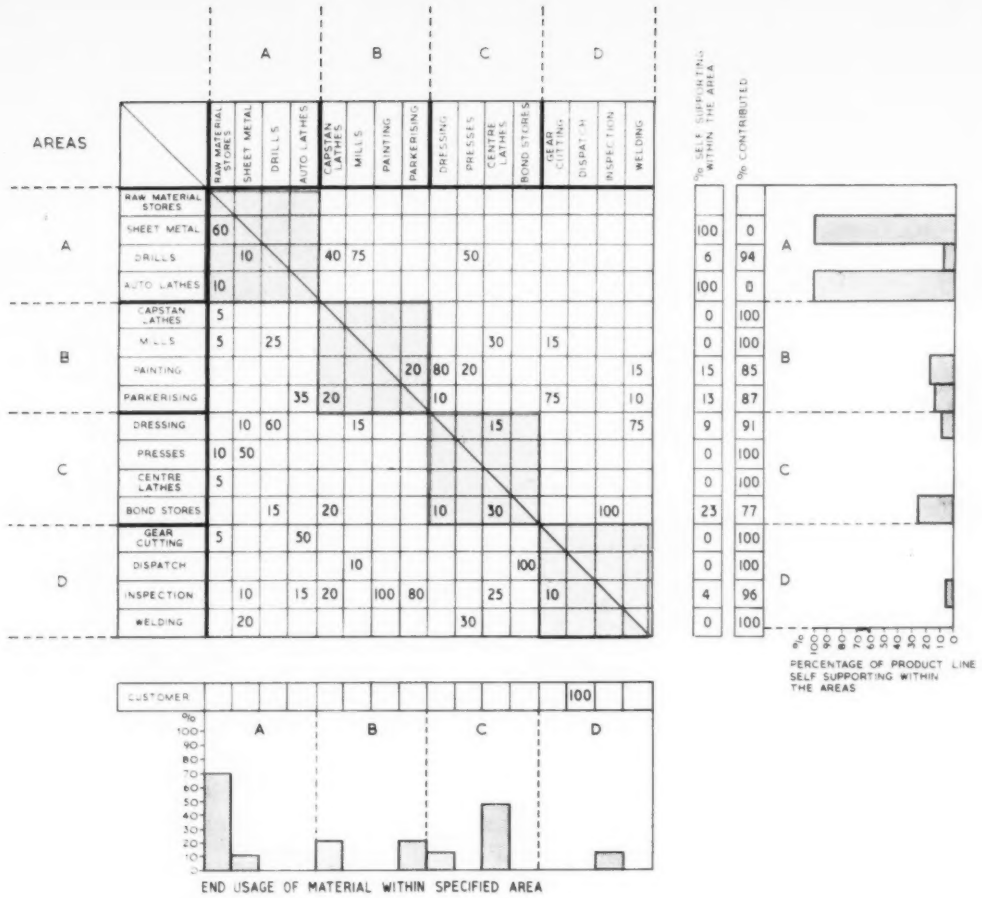


Fig. 2. Example of material travel chart as between four specified areas (A, B, C, D) and to and from processes within those areas. Measurement of material is normally in units or weight but if this is not practicable direct labour content can be used. Thus the output of any contributor area will be in terms of 100 *per cent of the direct labour content and allocated to receiving areas. The numbers falling outside the coloured squares on the chart indicate where materials have to be transported between areas. The objective would be to reduce these occasions as much as possible by re-layout. The closer the distribution of numbers to the diagonal line the shorter the distance of material travel*

our first layout problem because the unbalanced work flow makes it difficult to organize the handling of materials just as and when the need occurs and, as usual when this happens, the demand for space fluctuates.

So, in planning our receiving bays, goods inward inspection and stores receiving areas, do we allow for the average level of activity which, though statistically easy enough to determine, may never actually happen in practice, or do we allow for the peak load or somewhere in between? Space, I am always being told by storekeepers, or rather the lack of it, is something which haunts them in their dreams. This, despite the fact that the management often think they have too much of it. With both points of view I have some sympathy.

While not always agreeing with the storekeepers' ideas on what space they need, I am often amazed at the failure on the part of many managements to realize the importance of the storekeeping function. On the other hand, space is an expensive commodity and it is uneconomic to have more than necessary in reserve.

I have spoken of the spasmodic arrival of materials at the works and into the stores where they have to be racked, stacked or otherwise suitably accommodated until such times as they are issued to production. I will not dwell here upon the problem of stores layout, except to say that I have often found that when a storekeeper says he is cramped for space he really means that he lacks the facilities to effectively utilize space; a rather different problem that has an intimate relationship with the arrangement of the stores layout, its storage methods and equipment, its materials handling facilities and its general organization.

Materials issued to the production departments are usually issued on a more controlled basis since production is on a continuous cycle, well more or less so anyway. Additionally, of course, the materials will, most commonly, be issued in much smaller quantities than that in which they were received.

The stores therefore acts not only as a buffer but also as a filtering medium. The most usual form of production layout in the kind of factory I am discussing is the arrangement known as a process layout. Essentially, this means that the various machine tools and such other items of equipment as may be necessary are grouped together according to similarity of process, thus forming a number of sections.

In an engineering establishment, for example, such sections as autos, capstans, mills, drills, etc., in a bookbinding works a guillotining section, collating, sewing, rounding and backing, and casing sections, and so on, according to the nature of the manufacturing processes involved. If a number of different products, or a product involving a number of different components, is being made, the destination of materials issued to the factory is likely to vary from batch to batch. A number of different operations are likely on each batch before the parts involved become finished components and since, as I have said, the nature of the processes may vary with each succeeding batch, the

pattern of movement through the factory tends to get complicated.

This problem of movement is one of the most difficult problems to analyse in planning layouts for batch production, and I propose to discuss it in more detail later. At intervals during the manufacturing cycle it is usually necessary to inspect the quality and check the quantity of work done. These activities therefore must be catered for in the layout.

Since the basic principle of batch production involves the issue of materials in batches and their processing as such in the various process sections, it is obvious that at all times there must be batches awaiting processing and batches waiting transfer from one section to another. According to the way in which the functions of inspection and checking are carried out there may also be some waiting time incurred at inspection and check points. These batches of work are usually referred to as 'work in progress'.

Nobody with any experience in the running of a batch-production plant will dispute the need for work in progress: the critical question is how much? Leaving aside, for the moment, this difficult question of how much work in progress there should be I am continually amazed at the number of factories I see that appear to proceed on the assumption that no 'work in progress' exists. This ostrich-like policy on the part of many managements, resulting in failure to make proper provision for the accommodation of work in progress, is largely the reason why it is quite common experience to see materials cluttering up working areas on the processing sections, obstructing gangways and aisles and in many other ways causing disorganization and frustration.

Usually we find that when the situation in such factories is analysed they are carrying more work in progress than ought to be necessary. Of course they would be because this kind of situation is part of a vicious circle in which they become involved. No wonder work in progress has been referred to as the 'graveyard of the profits'.

In the production of commodities with an engineering content such as, for example, washing machines, electric motors and the like, the production of the various components usually completes a distinct stage in the manufacturing cycle. The next stage is usually the building up of sub-assemblies, followed by the final assembly of the finished articles.

Fig. 3. A typical example of the result of the lack of planning, control and proper equipment within a stores area

Between manufacture and assembly therefore we commonly find a component or piece part stores which, again, serves the purpose of a buffer and filter, since, for a number of quite valid reasons, it is seldom possible to balance the production of the bits and pieces with the requirements of the assembly sections.

The layout of the sub-assembly and final assembly sections of the factory are quite clearly the ones most affected by the nature of the product and the organization of the assembly processes, but in many instances it is possible to introduce an element of flow line production. That is to say, the kind of arrangement whereby as different stages in the work are completed the assembly moves along from one position to another; the method used in the motor car industry and many others.

The layout of assembly sections requires a somewhat different approach to that of manufacturing areas, questions of timing, balance, rate of flow and the mechanics of the job, etc., coming into much greater prominence.

The nature of the provision that is made for the warehousing and despatch of the finished product is, in large measure, determined by the marketing and distribution policy. If the product is such that the demand is seasonal or subject to fluctuation for some reason then extensive warehousing facilities might be necessary. On the other hand, the demand might be reasonably stable in which case the space required could be kept to the minimum consistent with the need to maintain some reasonable short-period buffer stock.

Apart from the question of determining the volume of space required, there is no very special problem involved, from a layout point of view, in the warehousing and despatch of the finished product. There may be difficulties due to site conditions and other like factors but such difficulties have to be reckoned with wherever they occur.

This, I think, sums up the general case and the conditions of a batch production factory and I am sure that those of you who are familiar with such factories will agree that my description has been pretty fair.

There are, of course, many ways in which this general pattern may be adapted or modified to suit particular situations, but these divergencies do not invalidate the basic principle of production organization involved.

There are a number of reasons why it might become necessary to consider the layout of a factory or some part of it. One reason could be the setting up of a new factory to manufacture a new product or perhaps a company might move from one factory building to another with its existing range of products. Other reasons might be the introduction into an existing works of an additional product or products, involving new manufacturing techniques. Or again, the development of new production methods or more modern plant may call for the revision of the layout as a whole or in part.

The last reason that I have in mind is one that is recognized least of all in practice but which, in my opinion and experience, should head the list. It is that the layout of every factory ought to be periodically reviewed, and modified if need be, because minor changes in techniques, methods, plant, equipment and organization are occurring all the time in progressive companies and their cumulative effect, even in a short period of two or three years can be quite considerable. In my opinion these progressive changes, coupled with gradual expansion of the company's activities, desirable though they may be in themselves, are the cause of a great many inefficient layouts today.

As it is obvious that I cannot discuss all the different layout possibilities I have just mentioned, I am going to concentrate on the problems of replanning an existing

Fig. 4. A carefully planned work area (armature winding) coupled with flow line principles of movement. Note the use of headroom to provide transport of parts off the floor and clear of the work area in the overhead conveyor at top right

factory. This is usually the most difficult situation and in any event the principles I shall discuss are those that apply in most cases.

First of all, then, how do we tell whether a layout is good or bad. What do we look for in order to make judgments. In order to illustrate this I propose to walk, in imagination of course, through a typical batch production unit and tell you on what I should base my first assessment. Before doing so, however, I must make one general point of fundamental importance and that is that it is not possible to consider layout as separate from materials handling. Layout and materials handling, if we are considering the factory as a whole, are so interconnected and interdependent that neither can be properly studied without regard to the other.

On the assumption that you will accept this contention as a matter of principle I shall proceed to consider them together.

As starting at the beginning is usually the logical thing to do, we should first look at the arrival of raw materials. We should want to know what these materials were, in what form they were received and by what means, i.e. by road, rail or water, or even by aircraft. We should want to know the frequency of material deliveries and we should examine the general suitability of the receiving bays or docks in relation to these various factors, looking at such aspects as manoeuvring space, parking areas, etc. Of primary importance will be the kind of materials handling equipment available and its suitability in relation to the actual materials received and the manner of their arrival.

The space allocated to the receipt of materials will be checked and related to the actual area available as all too frequently we find that receiving areas become cluttered up with materials not cleared, awaiting inspection or even apparently abandoned. The procedure with regard to checking and inspection of inward materials varies from one factory to another. In some cases these functions are regarded as part of the goods receiving set up, in others as part of the stores and quite frequently as a separate section. In any event we should examine the facilities and area allocated for these purposes and look for any likelihood of hold ups occuring.

In passing, I might mention that the checking and inspection of goods inward is frequently a bottleneck activity and we often find that part of the reason for this is slowness in pushing the appropriate paper work around. In the raw materials store we should first of all walk around and observe its overall appearance, looking for orderliness and general good housekeeping. These in themselves do not automatically denote efficiency, but untidiness and bad housekeeping almost invariably indicate inefficiency.

We should discuss with the stores superintendent such matters as stock levels, issues and receipts and get some impression of the volume and variety of materials held. Next we should examine the suitability of the storage methods and equipment and consider the system of stock recording and location. The efficient running of a store is very much a combined operation, since the methods of storage, the handling equipment, the system of stock location and the layout are very clearly dependent upon the nature of the materials themselves, the volume held and the frequency of turnover.

Here are just a few major faults we now expect to find, almost as a matter of course, in any works stores that we examine:—

1. Materials stored in unsuitable shelving, i.e. light materials on heavy duty racks and vice-versa.
2. Racks and bins not suited to the materials held.
3. Other racks, bins or shelves, only partially filled with materials.
4. Odds and ends piled on top of bins.
5. Materials dangerously stacked or piled on the floor.
6. Gangways and aisles obstructed by unallocated materials, often in crates or parcels.
7. Identical materials stored in different locations.
8. Much obsolete and redundant stock.
9. Inadequate, unsuitable and even dangerous handling equipment.
10. Poor lighting arrangements.

In listing these most common faults I want to make it clear that I am not having a go at storekeepers in general. Often they are all too aware of them. No, the guilty party is quite likely to be a manager with false notions on keeping down overheads.

One more important factor in the stores we should check is the number of people employed in relation to the work load. It is quite possible to provide a reasonable stores service to production however badly the materials are handled and stored if sufficient stores staff are employed. But it is not a very economic method.

A tour round the manufacturing sections will soon show whether or not much thought has been given to the layout of the various departments.

Orderliness and good housekeeping will again provide some criteria of judgment as will the existence of clearly defined gangways and aisles and the provision of properly equipped work in progress areas. The pattern of the work flow through the factory is not usually immediately apparent from a visual appraisal but we should look for any obvious evidence of back and cross trafficking. The volume of work awaiting processing on each section or awaiting movement to other sections gives us an indication of the effectiveness of the production planning and control techniques and some pointers to any deficiencies in the handling of materials.

Incidentally, I must say at this point that unless there is some reasonably effective production planning and control, no planned layout or system of handling materials can be expected to be fully effective.

On our general tour around the manufacturing sections we shall all the time be judging the quality of the materials handling methods and equipment. If there are any conveyors, do they deliver the goods where wanted and are they fully operative? Do any of them impede the movement of personnel or hinder the handling of materials by other means? If overhead conveyors are in use, do they interfere with the lighting by throwing moving shadows over important working areas? If mobile trucks are used, are they fully employed or are they generally loaded only to half capacity or less?

These, and many other similar observations, will quickly serve to indicate whether the materials handling methods have been planned for a purpose or instituted on an 'ad hoc' basis. On each individual processing section we should note the arrangement of the machines in relation to each other and to the work flow and we should look at the layout of the working area at each machine.

In looking at the layout of the finished parts stores similar assessments to that made in the raw materials store will apply, though the storage methods and equipment may be somewhat different and there is likely to be the need for greater care in avoiding damage. The manner in which components are collated and assembled for issue to the assembly sections will influence the detailed arrangement of the layout of the store, but space utilization, accessibility and suitable handling equipment will still be important considerations.

I do not propose to say very much about the layout of assembly sections since, as I said earlier, the layout of such sections can vary enormously with the nature of the product and the volume and rate of output. In any event many of the basic principles of layout practice will apply whether we are dealing with the production of components or their assembly into finished components.

Developing Good Layouts

Now let us consider some of the requirements and the techniques needed for the development of good layouts and let me say right away that there is much more to it than manœuvring templates or models around on sheets of graph paper. First, we must have some basic purpose as our aim and that, in a manufacturing establishment, must be expressed in terms of a manufacturing target, i.e. the production of 'X' number of items in 'Y' period of time.

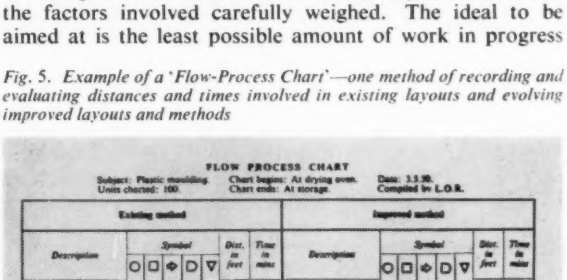
I do not suggest that we can so balance our production resources that no more or less than the target can be accomplished, but the target must be related to the resources within a reasonable margin of tolerance. Some flexibility must be allowed for, of course, but the economic consequences of too much flexibility must not be ignored.

The manufacturing target has to be translated into terms of processes and processing times from which may be determined what plant and equipment is required and how much of it. This basic information, in an existing establishment, should all be available in some form or other, as process layouts, work schedules, piece-work rates, time studies, etc.

Having determined, from an analysis of the processes and processing times, the kind and quantity of equipment required, we can now consider the way in which it should be grouped and, if we are dealing with an existing plant, check the theoretical with the actual. Next, we have to consider the question of the volume of work in progress that must be catered for on each section and this involves consultation with the production planners to establish what is, or should be, the reasonable level. It would, I think, be very unwise of me to offer any opinion as to what should be a reasonable level of work in progress. To generalize in this matter would be most misleading.

Each particular case must be individually considered and the factors involved carefully weighed. The ideal to be aimed at is the least possible amount of work in progress

Fig. 5. Example of a 'Flow-Process Chart'—one method of recording and evaluating distances and times involved in existing layouts and evolving improved layouts and methods



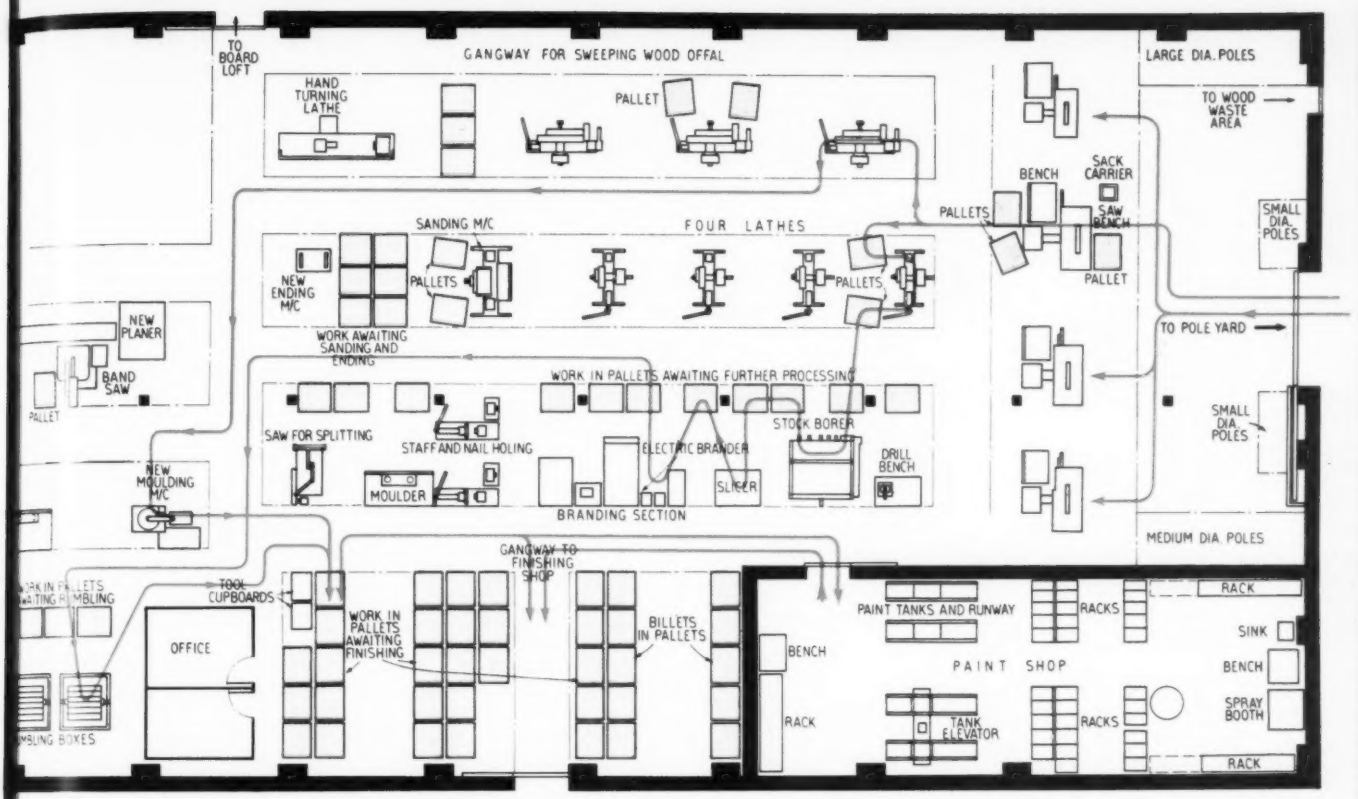


Fig. 6. Example of a flow diagram—a method of graphically relating the movement of men and materials to an existing or new layout

consistent with the average rate of throughput, the requirements of control, effective machine and labour utilization and process flexibility. Difficult though it may be to assess the volume of work in progress, some reasonably accurate estimate must be made because of its effect on the layout in respect of both space and handling.

Next, we have to examine this question of materials handling and make some decisions as to what the basis of the materials handling system is to be in relation to both the general movement of materials throught the plant and the movement of work within the various sections. Here, again, generalization would be dangerous, but with the wide range of equipment now available there is no problem of materials handling that cannot be solved if the requirements are studied and analysed. There are, however, a number of principles of materials handling that apply in all circumstances and they should be kept constantly in mind. These are some of them:—

1. Plan materials handling for overall economy.
2. Select the simplest equipment applicable to the job.
3. Standardize on equipment where possible, but do not expect one kind of equipment to be universally suitable throughout the plant.
4. Co-ordinate the operation of equipment.
5. Plan handling on the basis of unit loads where possible.
6. Keep materials off the floor.

Having examined the requirements and set up our standards for the production departments, we have now to consider the receipt and storage of the raw materials and their issue to the factory. As I said earlier, the arrival of materials at the works is likely to be spasmodic and moreover, if a wide range of different materials are used, the order in which they might arrive is somewhat unpredictable. Such circumstances usually require a fair degree of flexibility in both the layout, the receiving areas and the handling equipment provided.

A raised unloading platform, serviced by an overhead gantry crane, is a very common arrangement and does permit a high degree of versatility. It also usually allows the unloading of materials from lorries by means of trucks. There are, however, several disadvantages to the use of raised loading docks, the principal one being that they tend to become a restriction on future developments should the nature of the problem alter.

For example, we have often found that the existence of loading docks limited the use of fork trucks for unloading vehicles and this restriction is likely to occur more and more often. On balance, in a new factory, I think I should prefer to do without raised loading and off-loading platforms.

For the replanning of the raw materials store itself it is necessary to establish what levels of stock must be accommodated and what the rate and frequency of turnover is likely to be in relation to the different materials involved. This will require some knowledge of the buying policy of the company, since this can materially affect both stock levels and the rate of turnover. With this information we can then turn to the consideration of the actual methods to be used to store the materials, since this will be a major factor in determining the arrangement of the layout.

Before we can start to design or redesign a factory layout we must also examine and assess the requirements of such service departments as the tool room and tool stores, the maintenance section, etc., and we must ensure the provision of the necessary facilities for inspection and checking.

Other important factors that must be taken into account but which my time does not permit me to discuss in detail are such questions as the limitations imposed by the structure of the factory buildings and the availability of natural

Fig. 7. Materials handling is an integral feature of good factory layout

lighting. Also we must have regard to the provision of essential services such as light, heat, power and air, and neither must we overlook the welfare of the workpeople and fail to provide sufficient canteen and cloakroom accommodation and other such facilities.

Although I have not said so in so many words, it will, I am sure, be obvious to you that, in fact, I have been discussing the recording and analysing stages of work study as applied to plant layout and the questions why, what, where and when will have been posed many many times throughout every stage of the investigation I have described. The important thing is that before starting to develop a layout we must be sure of the facts, all the facts, that have bearing on the problem.

Now what can I say about developing the best layout to meet the requirements and conditions shown to be necessary from the analysis of the facts and what techniques should I describe that will contribute to this end? The illustrations show some work study techniques that we use and, as necessary, all the other techniques of work study are applied.

Flow diagrams, drawn on accurate plans of an existing layout, are used to show the trends of the general flow of work around the plant as a whole and the detailed flow on each particular section and work place. These might take the form of string diagrams where applicable.

Where the flow of work tends to be complicated as in batch production, it is often necessary to devise special work movement charts or to use activity sampling techniques. From an analysis of these diagrams together with flow process charts it is then possible to begin to plan the broad outline of a new layout arranged to secure the most logical disposition of the various sections in respect of material, work and labour movement.

Having determined the broad outline of the overall layout it is then necessary to plan each section in detail and this is where templates, or better still, scale models may prove invaluable.

A number of alternative arrangements always have to be considered and in the end it is usually necessary to effect a compromise between what is ideal and what is possible, so as to make the best use of the available area. All the time the methods of handling materials must be taken into account and therefore we must be concerned with the question of accessibility, for that purpose and the maintenance of the machines.

Having established the general arrangement of the layout and the details of the arrangement of the processing plant, we now have to make provision for the accommodation of work in progress on the one hand and work awaiting transfer on the other. Also we should make such provision as may be possible for future expansion where this can be forecast.

In this manner the general arrangement of the new layout and all the detailed layouts gradually emerge until what is agreed to be the best possible is developed. Notice that I say 'what is agreed to be the best possible' because I am a firm believer in seeking the co-operation and finally the agreement of those who will ultimately be responsible for the success of the layout under operating conditions.

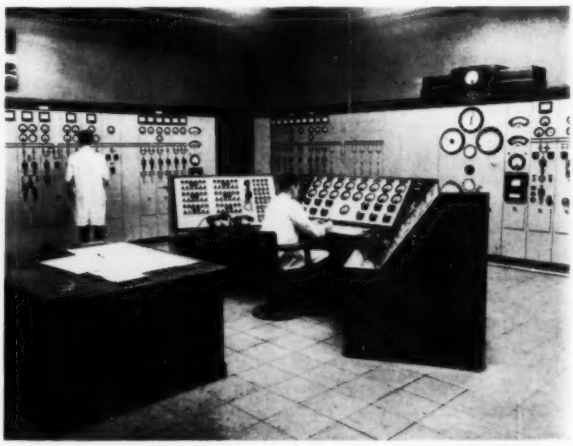
I began this talk by stating that management's task was the maintenance of a proper balance in the operation of a company's resources; that the achievement of a proper balance depended on the degree of planning, co-ordination, motivation and control that is applied to those resources.

I hope that I have brought out and underlined the fundamental pre-requisite to all management work—of which factory layout is but one aspect—that is the acquisition of the FACTS of the situation, be it physical or financial, the analysis of those facts in the light of recorded experience and future requirements and finally the logical sequential planning of inter-related action in order to achieve a desired object.

There is no magic wand or pre-ordained set of techniques in the establishment of an efficient factory layout. The prime aim, as has already been stated, is to so arrange the receipt, storage, production and ancillary facilities 'to permit the quickest flow of materials at the lowest cost, with the least amount of handling'.

Thus no item however small in relation to others must be overlooked or taken for granted. On the other hand the layout engineer must accord proper priorities to the significant factors and thus achieve the integration and balance of the limited means available with the desired objectives.

Fig. 8. Layout planning is not only applicable to machine tools and assembly operations but should affect the arrangement of all work areas and offices—as in this control room



Materials Handling in a Heavy Engineering Plant

By V. Wolpert

THE MATERIALS HANDLING COSTS in heavy engineering are estimated to amount to 20-30 per cent of the machining and assembling costs. Great attention was therefore paid to the simplification of materials handling in the planning of the new heavy engineering plant of Sulzer Brothers, Ltd., Winterthur (Switzerland), with a view to achieving an important saving of costs. The new plant at Oberwinterthur which was recently taken into operation shows clear evidence of this planning.

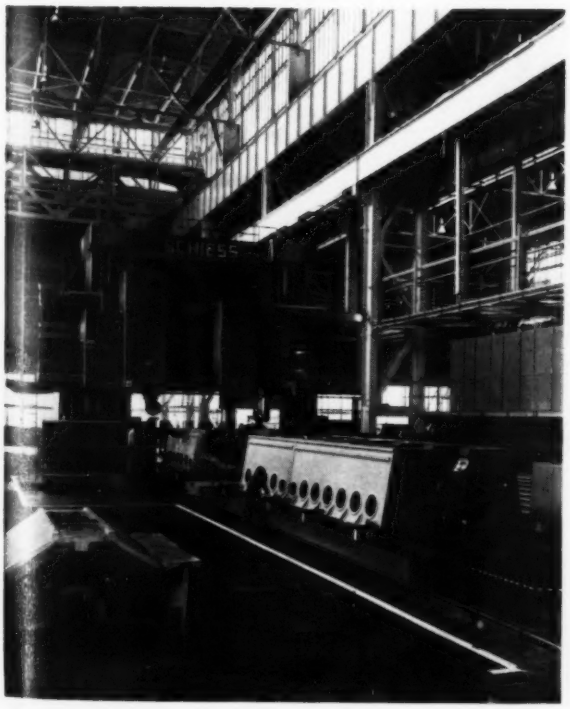
1. A high degree of efficiency was introduced into materials flow systems, a feature resulting in reduction of handling costs within the manufacturing process.

2. Type, size and layout of the cranes selected took into account present requirements as well as the envisaged extension of the new plant and its manufacturing programme.

The manufacturing programme of Sulzer Brothers, Ltd., includes diesel engines ranging from 300 to almost 24,000 b.h.p. per unit for marine, railway traction and power station units.

The new heavy engineering plant which was erected next to the new Sulzer foundries is at present used for machining the following types of components: large diesel engine castings, gas turbine castings, components for boilers and steam-raising plant, components for large pumps, and components for compressors. The plans for the extension of the new bay which are already laid down provide for the building of nuclear reactors in this plant.

Fig. 1. Bay 1 for machining large-sized components



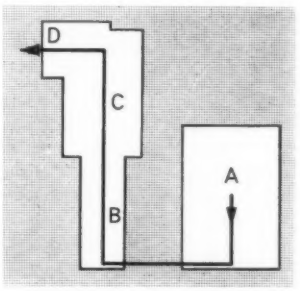


Fig. 2. Future production flow of baseplate—A, foundry; B, heavy engineering bay for machining; C, assembly bay; D, despatch

The layout of the new plant took into consideration that about 7,000-8,000 tons of castings are used for diesel engines annually, and that the weight of relatively few large-sized components accounts for approximately 50 per cent of the overall weight of the diesel engines. The new heavy engineering plant consists of two bays parallel to each other, namely: Bay 1, about 550 ft long and 118 ft wide, which houses all machine tools required for the production of large-sized components. Machine tools for the production of medium- and small-size components are installed at the far end of this bay, again as a self-contained section. This layout ensures that the largest components of diesel engines, e.g. base-plates and plinths, are machined in a highly efficient manner with an important reduction of the amount of handling of workpieces and a resulting saving of production costs, Fig. 1.

The second stage of this plant envisages an extension of

this building to a length of nearly 1,200 ft. After the completion of the second stage, large machined diesel engine components will move to the pre-assembly, final assembly, testing and dispatch stations in a straight flow line.

Bay 2, 550 ft long and about 100 ft wide, houses two parallel lines, one for the production of crankshafts and the other for production of cylinder liners and pistons.

Cranes

The new long bays 1 and 2 have the advantage that the workpieces are moved along the same crane track, a feature eliminating expensive and time-wasting traverse movements. An analysis of the frequency with which certain materials are moved within the machining bay, related to the weight of the workpieces, shows that: workpieces up to 10 tons account for 30 per cent; between 10 and 25 tons account for 45 per cent, and workpieces of over 25 tons account for 25 per cent of the handling time.

This analysis led to the adoption of a carefully planned layout of the crane installation which is as follows: each bay has two crane tracks which are largely independent. In Bay 1, for machining of heavy workpieces, Fig. 3, the upper track accommodates cranes of 125 tons capacity and an additional 10-ton hoist. The 125-ton crane has a weight of 152·7 tons and the total rating of the motors installed in the crane amounts to 336 h.p. At present one 125-ton crane, built by Von Roll, Ltd., has been installed, but further cranes of this size will be added later. Workpieces of up to 250 tons could be handled after the installation of a further 125-ton crane. At present also a 10-ton crane is installed on the upper track.

The lower crane track is designed for smaller cranes, the main advantage of this layout being that the smaller cranes, which handle about 75 per cent of the overall material, pass underneath the heavy cranes without requiring the latter to be moved sideways. At present two cranes of 25 tons, with 7-ton high-speed action, built by UTO and one crane of 10 tons built by Weisser & Hibbert, are installed on the lower track, but it is intended to add further cranes of these sizes later.

A 2-ton crab, which moves across the track, was installed for repair of the crane motors. This crab can lower and raise a 20-ton electric hoist. In Bay 2, where machine tools are installed in four rows, there are at present two cranes of 10 tons capacity each, and one of 25 tons, as well as two luffing cranes of 10 tons capacity, each with a jib of about 33 ft length, Fig. 4.

An interesting auxiliary crane equipment is a 23-ft high rack on which wire-rope hoisting equipment is stored, Figs. 5 and 6. The crane picks up from the rack the required wire-ropes and after the completion of the hoisting operation places them back on the rack.

In addition, there is a crane track for one 60-ton crane between the foundry and Bay 1. This crane is intended to control intermediate storage and stocking of castings before their machining.

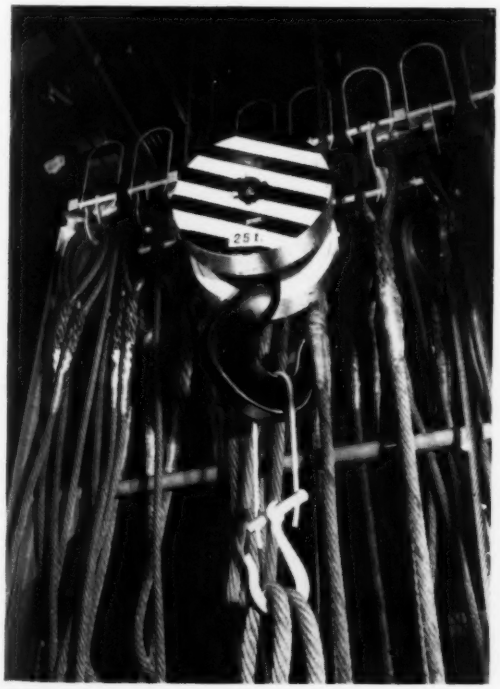
The new Sulzer plant shows a great advantage in the technique of materials handling as well as in specialization within a large plant by installing the necessary machinery as self-contained units.

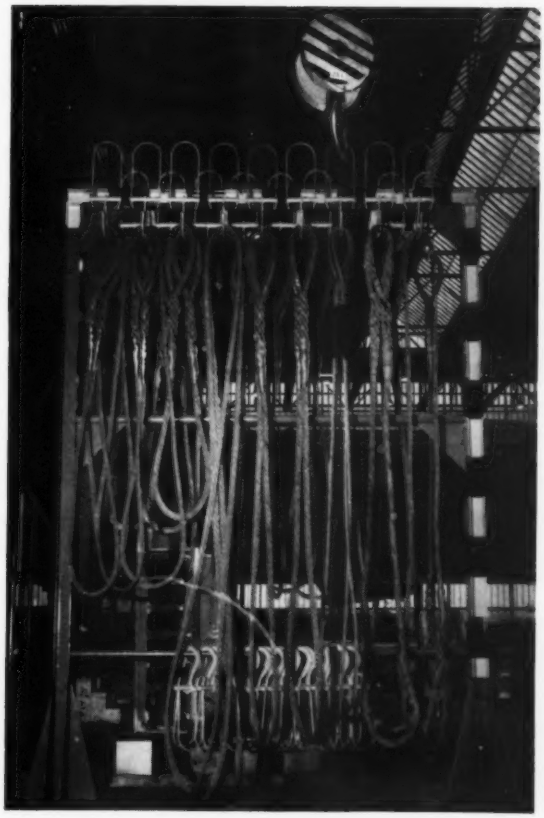
Fig. 3. Another view of Bay 1 for heavy machining

Fig. 4. *General view of Bay* 2

Fig. 5 (*right*). *23-ft high rack for storing hoisting equipment*

Fig. 6 (*below*). *Close-up of storage rack*





INDUSTRIAL EFFICIENCY AND SAFETY EXHIBITION

Fig. 1. General view from the balcony stairway, showing the central gangway and exhibitors' stands in the main hall, City Hall, Manchester

THE Industrial Efficiency, and Safety Exhibition, sponsored by the Institute of Works Managers held last November, was housed in the City Hall, Deansgate, Manchester. Some 78 exhibitors occupied the building, which comprised not only the main ground floor area, but also the balcony, and a smaller adjoining hall.

As the name of the exhibition implies, exhibits covered a fairly wide field, including such diverse items as space-heating units fork lift trucks, safety clothing and equipment, and business machines. While a number of exhibits were of general interest to industry and commerce, a representative selection of exhibits of particular interest in the mechanical handling field were on show.

Abisch Conveyor and Furnace Co., Ltd., jointly with Industrial Belt & Screen Co., Ltd., London, N.W.3, showed a selection from their range of wire mesh belts, friction belts and chain-driven belts, together with illustrations of their glass-toughening plants, and continuous furnaces.

Coventry Climax Engines, Ltd., displayed one of their 1 GET electric fork lift trucks with a capacity of 2,000 lb and a minimum turning radius of 61½ in. Their fork truck range was also represented by a diesel-engined truck with 4,000 lb capacity, model 1 GDA. In addition, two examples of their well-known fire pumps were on show, models FWMP and FWP, with outputs of 250 and 350 g.p.m., respectively.

Gough & Co. (Hanley), Ltd., carried a range of general purpose trucks, both manually and power operated, and are authorized dealers for Lister items. Builders', decorators' and municipal equipment was also shown.

Jewsbury's Mechanical Handling, Ltd., offered a selection of 'Ameise' Retrak reach fork lift trucks, including both 'stand on' and 'sit on' models. Items from the Wrigley range were on show and included the E.650 electric fork lift truck, industrial trailers, electric tractors, and general purpose trucks. A diesel fork truck from the 'Matbro' range was also shown.

A. L. Marshall (Carlton), Ltd., specialized in conveyors, including the ALM 'Pacemaker', a portable band conveyor/elevator, which can be used either horizontally, or with a delivery height of 7 ft 3 in. Other items in the ALM range are the Masterveyor, and the retractable roller conveyor.

Vibro electric equipment was shown by Podmores (Engineers), Ltd., and a spiral elevator demonstrated the functioning of this type of equipment. The company also specializes in vibrating laboratory equipment.

Fig. 2. Matthew Swain, Ltd., of Failsworth, Manchester, featured the collapsible and stackable wire mesh Omicrate, and the Omic Paliton hand pallet truck. In the background is their new space heater, and vitreous enamelled curtain walling

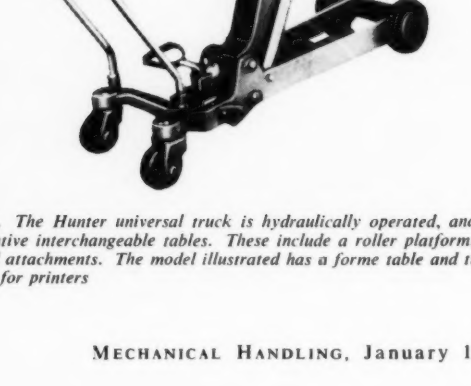


Fig. 3. The Hunter universal truck is hydraulically operated, and has alternative interchangeable tables. These include a roller platform, and special attachments. The model illustrated has a forme table and tilting device for printers

The Conveyancer range of equipment includes diesel and electric fork lift trucks with capacities from 2,000 to 7,000 lb, including flameproof and reach trucks, and is offered by Conveyancer Fork Trucks, Ltd. The range also includes Shorland straddle carriers, and selected items were shown on stands 101 and 102.

Matthew Swain, Ltd., exhibited a typical collapsible and stackable wire mesh Omicrate on behalf of Omic, Ltd. They also showed the Paliton hand pallet truck, also by Omic, Ltd. Other activities were represented by their new space heater, and vitreous enamelling for curtain walling.

H. C. Slingsby, Ltd., showed a comprehensive selection of trucks, castors and other aids to the safer and better handling of all kinds of loads.

Pallet racks, steel shelving, and the Tiltrack range, providing flexible storage, were displayed by Bertram Thomas (Engineers), Ltd.

Drums, barrels, bins, carboys and cases are handled by the special equipment offered by Powell & Co. The *Stak-a-Drum* for stacking drums in pairs or threes, the 'Universal' barrel stand for side-pouring viscous liquids and the *Safe Way* carboy tilter are a few items from the wide range of devices offered in this field.

G. Hunter (London), Ltd., showed specialized stackers for loads up to 1 ton. These are fitted with interchangeable platforms which can be rotated through 360 deg, and which will move laterally up to 6 in on either side of a swinging arm. These versatile machines have a variety of uses, particularly in confined conditions. A model of a new counterbalanced dock ramp also created interest. Based on a system of levers and counterbalancing weights, no power supply is required. The steel platform is pivoted at the inner end, and its curved outer end projects a few inches beyond the edge of the static bank. Finger-tip pressure raises the loading end to suit the platform height of the vehicles concerned.

Stands Nos. 98 and 100 housed the exhibits of E. Boydell & Co., Ltd., who manufacture the Muir-Hill hydraulic loader and dumpers. The improved LH-I loader has a bucket capacity of 10½ cu. ft., and reduced overall width, together with additional reach, has greatly increased this machine's all-round ability.

RAILWAY WAGON LIFT

To enable goods to be handled directly at all floors of the company's bonded warehouse, a 40-ton wagon lift has recently been installed in Vienna by 'Intercontinentale' Oesterr, A.G., a wholly-owned company of the Lep Group Ltd., whose headquarters are in London.

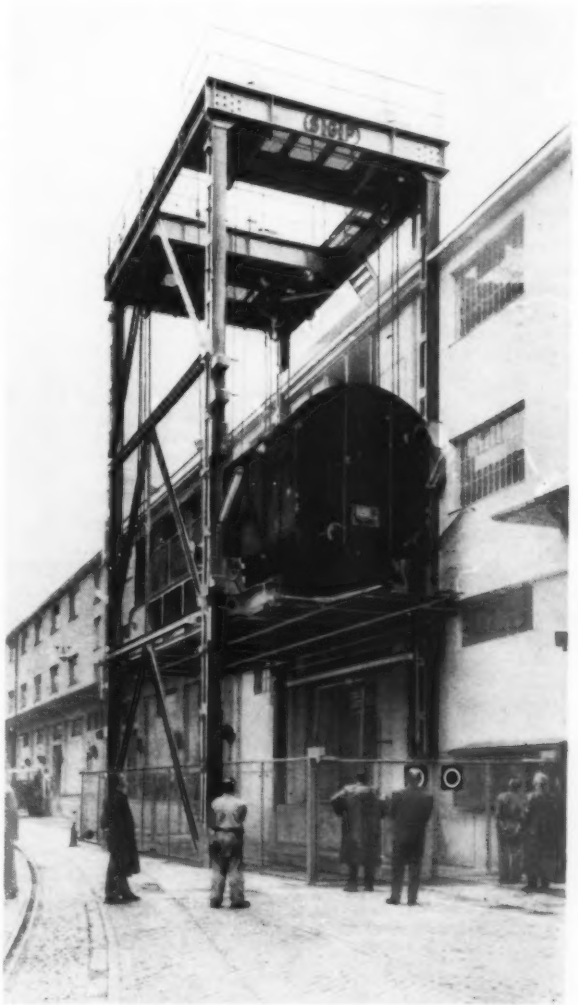
Claimed to be unique, this railway wagon lift is capable of raising fully-laden trucks from the ground floor to the first and second storeys, and was designed to meet the ever-increasing need to rationalize transport by speeding up individual stages, reducing effort to a minimum and moving goods only on one level, if possible.

Installed by Simmering-Graz-Pauker A.G., of Vienna, the new lift is powered by a 46-h.p. electric motor controlled from the ground floor level which operates through 16 wire cables of 20 mm diameter located at the four top corners of the lift framework.

The railway wagon to be lifted is shunted over entry-tongues on to a platform at ground level, movement of the wagon then being prevented by blocks at both ends. When the platform is raised, bolts automatically engage with the wagon as an additional safeguard. While the wagon is in a raised position at the first or second storey for loading or unloading or to allow another wagon to be shunted under the raised platform, props automatically support the platform.

As the platform approaches the upper-floor connection, the lifting speed of 10 ft/min is reduced by half to 5 ft/min so that there is no jolting when it comes to a halt. The platform then rests on the props and the strain is removed from the cables. The approaches to the lift shaft from both the ground and upper floors of the warehouse have safety gates fronting on to the shaft. These gates are automatically bolted by an electrically operated mechanism. The working of the lift is such that the correct level at the upper floors is attained automatically by the action of a floor 'feeler' device which reduces the adjustments necessary to bring the hoist in correct alignment with required warehouse floor. Not until the raising operations have been completed can the protecting gates be opened.

On completion of the new handling system the premises were subsequently visited by the Prime Minister of Austria, Dr. Julius Raab, who showed great interest in the distributing activities of Intercontinentale A.G.



CONVEYOR INSTALLATION IN A BANANA WAREHOUSE

By A Special Contributor

TIMING, with regard to the transport, ripening and storage of bananas, is all important in order to ensure that the fruit is at its peak of ripeness, flavour and freshness when sold to the housewife. Thus the methods of transport and handling in bringing the fruit to this country, and its storage during ripening must be simple, flexible and capable of handling varying bulk quantities of the fruit.

Elders & Fyffes are pre-eminent in experience of this trade and have specialized in supplying the fruit from plantation to the consumer for 58 years. A recent addition to their extensive nation-wide warehouse facilities has been the acquisition of a warehouse at the British Railways goods yard, Barlby Road, W.10. The building, with facilities for handling rail traffic on one side and road vehicles on the other, has been virtually gutted internally and the most up-to-date equipment for the ripening, storage and handling of bananas has been installed. This warehouse was brought into operation in June 1959.

The major mechanical handling feature of the new warehouse is a 760-ft. long overhead monorail chain conveyor, supplied by Rendale Conveyors, Limited. Fig. 1 shows the plan and elevation of the warehouse; from this it will be seen that the conveyor transports the fruit between all the points of processing, i.e. the 34 ripening rooms, the receiving railway siding, and the points at which the cutting, grading, weighing and packing operations are carried out with the ripened fruit.

Sequence of Operations

A brief description of the sequence of events will help the reader appreciate the arrangement of the conveyor.

The bulk of receipts is made in enclosed railway wagons which are shunted into the siding adjacent to the warehouse unloading dock. At the moment seven wagons may be lined alongside the dock, but this latter will eventually be extended to the full length of the warehouse building to allow a total of nine wagons to be held in the siding at one time.

The stems of bananas, each weighing between 38/40 lb apiece, arrive enshrouded in plastic diothene bags. They are unloaded manually and carried into the building through five doors indicated on the drawing. Alongside each door there is a rack carrying a quantity of chains. These chains are used to hook each 'stem' of bananas on to the conveyor which runs the length of the building, parallel to the loading dock. It is imperative that the differing shipments of

Fig. 1. Plan and elevation of the warehouse

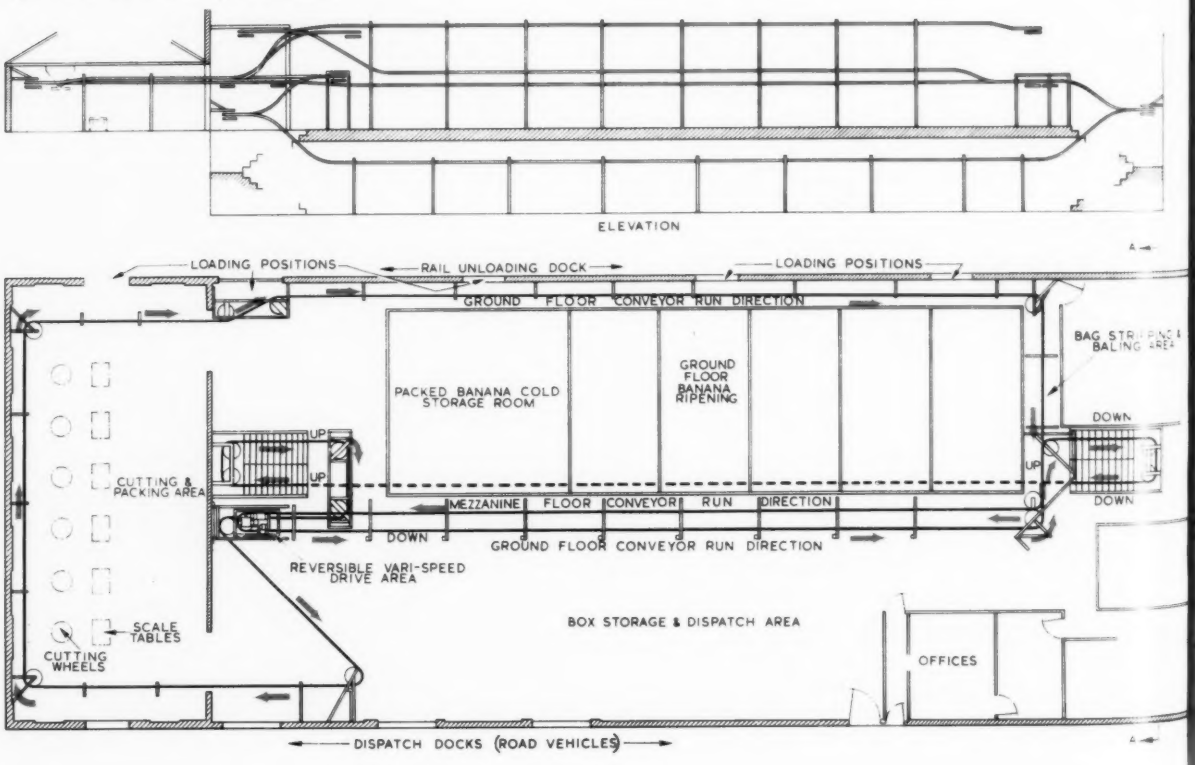


Fig. 2. Unloading area showing rack of banana stem chains. The unloading dock is through the open door on the left

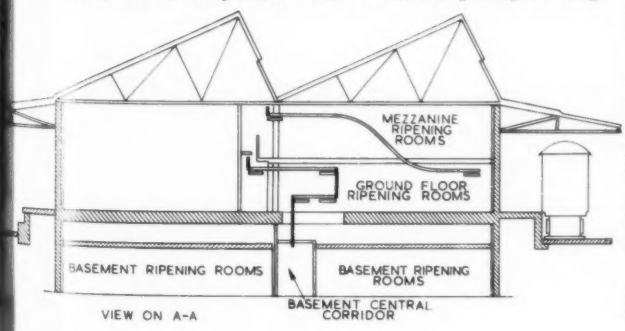
Fig. 3. General view of ground and mezzanine floor ripening rooms with Monorail conveyor serving both floors

deliveries can be identified at any stage of processing. This is achieved by having the chains painted with an identifying colour and allocating a particular colour to one shipment.

After being hooked on to the conveyor the 'stems' move to a bag-stripping area (see drawing). Here the diothene bag is stripped off and disposed of in an adjacent baling machine. The stems are then conveyed to the upper mezzanine floor where the conveyor passes in front of a series of ripening rooms.

The stems are off-loaded and hung in the ripening rooms available. If these rooms are full, or it is desired to use the rooms on the ground or basement floors, the stems are left on the conveyor which drops down to the ground floor at the other end of the building, passes in front of the ground floor ripening rooms and then descends to the basement floor where it runs through a central corridor with a series of ripening rooms opening off on either side. At the end of this corridor it rises to the ground floor and passes through the cutting and packing room. Here the fruit is cut from the stems, graded, labelled with the familiar Fyffes blue label, weighed and packed in 28-lb flats. The conveyor then links up at the unloading side of the warehouse, thus completing the full circuit of the building.

There are six suspended racks for the temporary holding of the stems during the cutting operation. The stems are taken off the conveyor and hung on these 'cutting wheels' providing a flexible storage buffer and thus reducing the possibility of ripened fruit from entering another complete circuit of the system. This allows for the full utilization of the conveyor in its main purpose as a transfer mechanism between process points.



Details of Conveyor System

At the beginning of the article it was stated that the nature of the fruit necessitated simple, flexible and eminently trustworthy means of handling. The writer believes that these requirements have been well met in the specification and arrangement of the Rendale Conveyor. Its component parts are uncomplicated and robust in design; construction, being, in essence, a series of ball-bearing trollies and hooks, at 2 ft 6 in pitch, running on steel joists, and linked up by a 15,000-lb breaking load, solid bearing pin endless chain with bi-planar links. The whole is driven by one electric motor and has facilities for variable speeds between 4 ft and 35 ft per minute using a hydraulic-type gear unit. Maintenance is confined to lubrication on a pre-planned schedule and is very simple—one operator being able to cope with the work quite comfortably. The conveyor is controlled, as to starting and speed, etc., from one point in the packing room but there are ample emergency stop switches along the whole length of the conveyor's circuit. Further, the conveyor is reversible, thus obviating the waste of time in having to allow any fruit to travel the whole circuit if, for any reasons, it has overshot its planned destination.

The conveyor is operated at its maximum speed of 35 ft/min and is continually working between 8 a.m. to 5 p.m., the only shutdown being for the lunch break. To date, no trouble of any kind has been experienced in running and this must be attributable to the basic simplicity and soundness of the design.

Fully loaded, the conveyor has a carrying capacity of 300 stems of bananas, a total weight of some 5 tons. All told the warehouse has a capacity of some 13,000 stems of

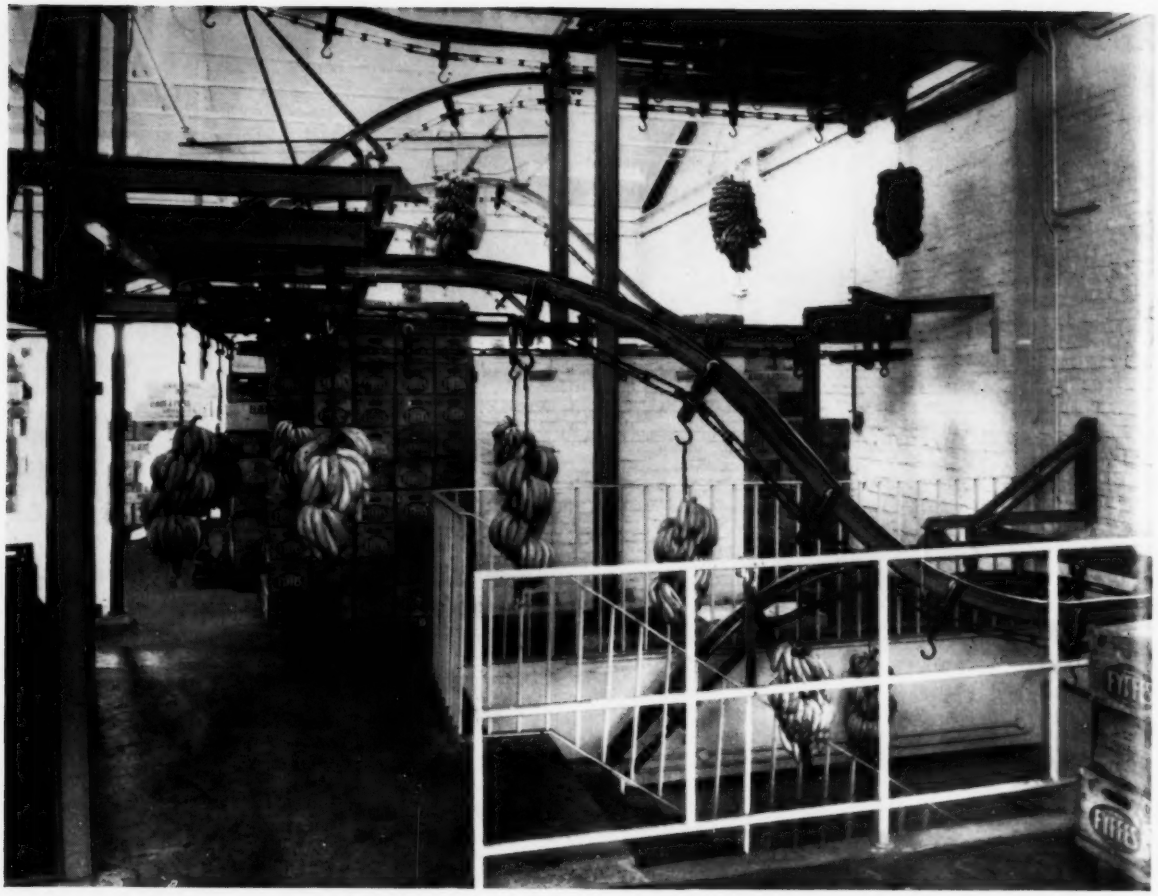


Fig. 5. General view of the arrangement of the conveyor system at the point of exit from the basement. The drive unit for the whole system is seen at the top right of this photograph by B.I.C.C.

bananas (200 tons) but as can be appreciated, with a ripening period of 4-5 days and being a highly perishable commodity, handling and throughput in any one week can fluctuate widely.

The company cannot afford the risk of breakdown in any sphere of its warehouse operations and, particularly, must have a well-nigh foolproof and flexible method of moving the fruit without bruising.

Fig. 4. Inside a basement ripening room, looking out to the central passageway and the conveyor. On the far side can be seen the entrance to another ripening room

Temperature Control

The ripening-time cycle is dependent on the degree of heat and humidity maintained within the ripening rooms and the various types of bananas demand the closest control of heating and ventilation.

Again, the ripening rooms are of varying sizes and as the point at which the fruit is fit to be packed and sent out is highly critical, an extremely flexible method of heating and ventilation must be available.

Each room has been equipped with a completely enclosed two-speed reversible fan. There are a number of controlled gas-heating units and nine thermostatically controlled overhead heaters which maintain the background temperatures at the correct level throughout the building.

British Insulated Callender's Cables, Ltd., supplied polythene-insulated p.v.c.-sheathed cable with watertight fittings for the lighting within the ripening rooms, because experience has proved that cables in conduits deteriorated rapidly in the prevalent conditions of humidity and temperature. For the general installation they supplied cables drawn through screwed conduits in the normal manner and p.v.c.-insulated cables were used for this purpose.

Altogether some 16,240 yards of B.I.C.C. cable have been installed by the electrical contractors, T. Adams & Co., Ltd. The main structural work was carried out by C. J. Sims, Ltd., and the banana ripening rooms are the work of J. K. Purdon & Son.

TWO NEW LOADING SHOVELS

CHASESIDE loading shovels and dumpers need no introduction to readers of *Mechanical Handling*, nor, indeed, to engineers and earthmoving equipment users generally. For thirty years the private family concern known as Chaseside Engineering Co., Ltd., has been steadily increasing its output of loading shovels and helping to popularize new design trends such as hydraulic control, four-wheel drive, and torque converter transmission.

These British-built machines are now well established throughout the world, not excluding Canada and the United States of America, where four-wheel drive Loadmaster shovels have proved to be highly competitive with American-built machines, with performances in no way inferior to the best of them.

The great problem facing the Chaseside Engineering Co., Ltd., until quite recently, was that of manufacturing on a scale large enough to meet sales demand. The company's factory at Hertford was, and still is, highly efficient, with its own foundry and well-organized machine shops and assembly bays. But it is not big enough to cope with present-day world trade possibilities. Those who are familiar with this factory have often marvelled at the compactness and practical layout of the works, despite severe restrictions of ground space and the need to modify ideal production layout to suit existing buildings. This was one of the reasons for the merger with British Northrop, Ltd., who acquired control of Chaseside Engineering Co., Ltd., in 1958.

The Blackburn factory of British Northrop, Ltd., is very large, with 1,100,000 sq. ft. of floor space on a 27-acre site. And, what is more important, it is well equipped and has behind it generations of experience of automatic looms, amongst the most complex of equipments sold on a highly competitive world market. In order to win and hold an important share in this market, British Northrop has developed what is believed to be the largest range of automatic looms offered by any one manufacturer anywhere. The market is, in this case, very competitive indeed, with rival manufacturers in Switzerland, Czechoslovakia, Germany, France, Japan and elsewhere.

The design and production organization necessary to back-up this range of automatic looms is extremely comprehensive, and this has rendered it economically possible to merge a range of other types of manufacture with loom manufacture, without weakening the ability to produce at short notice any of the range of looms offered, either in large numbers or in small lots.

To-day, in addition to automatic looms, British Northrop produces machine tools such as grinders, injection moulding machines and plastic extrusion equipment, much of which is on contract for outside firms. In addition, the factory's foundry produces grey-iron and non-ferrous castings in green sand and shell moulds, weighing from a few ounces to several hundredweight each. There is also a large woodworking department which produces bobbins and shuttles for looms and wooden components essential to loom construction. This department also designs and manufactures special purpose furniture for schools, hospitals and laboratories.

Fig. 1. Aerial view of British Northrop's Blackburn factory comprising 1,100,000 sq. ft. of floor space in a 27·18-acre site. Chaseside Loadmaster 1000 and Loadmaster 3000 four-wheel drive loading shovels are now being manufactured in this works

The merger whereby Chaseside Engineering Co., Ltd., fused with British Northrop, Ltd., is viewed as the starting point of a new development by the owners of the two companies. This is perhaps best illustrated by the fact that G. L. G. Jackson, who was managing director of Chaseside Engineering Co., Ltd., when it was still a private family business, is now managing director of British Northrop, Ltd. Chaseside Engineering Co., Ltd., is being maintained as a separate subsidiary organization and is regarded as the nucleus of the new construction equipment division of British Northrop, Ltd.

Hitherto, Chaseside loaders and dumpers were manufactured only at Hertford and production is, in fact, still being carried on there. At Blackburn a complete production unit has been set aside for the assembly of Loadmaster shovels. The floor space of this section of the works is about three times that of the total production area at the Hertford works. This fact is an indication of the scale of output expected from the new British Northrop-Chaseside link-up. Originally, Chaseside loaders were built on to Fordson tractors, but, with passage of time and the development of more powerful machines, Chaseside Engineering

Fig. 2. Mr. Gordon Jackson (left) and Mr. Watson watching a Loadmaster 3000 loading shovel demolishing an old air raid shelter, during a demonstration of the new Chaseside machine's performance. Mr. Gordon Jackson is now managing director of British Northrop, Ltd., and Mr. Watson is now sales manager of Chaseside Engineering Co., Ltd., which, since 1958, has been a component part of the British Northrop organization

Co., Ltd., commenced to manufacture complete machines. However, the comparatively recent development of ever-larger loaders made it difficult to produce everything inside the Hertford factory, for example, torque converters. Now at Blackburn, manufacturing policy will be to produce everything that it is practicable to produce. In practice that probably means producing everything except tyres and engines, judging by the British Northrop production policy regarding automatic looms, electric motors and tubing being the most important of the few loom components bought out.

Ultimately, Chaseside's Hertford works will be shut down, the firm's existing depot at Ware being retained as a sales and service centre. A number of Chaseside senior staff have already been transferred to Blackburn and it is understood that many other employees desiring transfer will go to Blackburn later.

Two Chaseside loaders are already in production at Blackburn, the Loadmaster 1000 and the Loadmaster 3000. During a recent visit to the factory the Loadmaster 1000 was inspected and the Loadmaster 3000 seen at work, in this case demonstrating its excavator-like capacity, by demolishing an old but strongly constructed air raid shelter.

During an interview, Gordon Jackson, managing director, said that both machines would be offered on the world market in the 1960 season. He looked forward to production of all Chaseside equipment at Blackburn. He went on to say that the two machines with their power crowd, power gear shift, and power steering, were likely to prove bestsellers. Referring to the link-up with British Northrop, Ltd., he said that the Chaseside firm would certainly benefit from the wide industrial experience of British Northrop, Ltd., and that British Northrop would benefit from more steelworks going through the works. Mr. Jackson continued by pointing out that the construction equipment industry is very cost conscious and stated that his opinion was that both buyers and employees would benefit from the new arrangement. There was still immense capacity for manufacture of earthmoving equipment in the Blackburn works, as well as for outside work under contract.

The New Loadmasters

During the visit embryonic production and assembly lines for Loadmaster 1000 and Loadmaster 3000 shovels were inspected. One might comment on these that they were both healthy embryos with all the signs of rapid uncongested growth to come.

Both machines are four-wheel drive hydraulic loaders, with torque converter transmissions, rear-mounted engines and 'tween axle driving cabins designed to give good forward visibility. Both machines will be fully described on another occasion after performance trials and close examination by a representative of *Mechanical Handling*. Meanwhile, the following brief descriptions and specification details may be of interest.

The Loadmaster 1000, shown in Fig. 5, has a 1½ cu. yd. nominal scoop capacity. Its maximum lifting force is 12,000 lb, maximum pry-out force, 13,800 lb, nominal payload, 5,000 lb, and maximum payload, 7,000 lb. The maximum traction force at stall is 10,700 lb, and the maximum safe gradient for this machine is 2·5 : 1, laden. Other specification details are as follows:—

Engine: Flexibly mounted four-cylinder four-stroke diesel engine. Overhead valve gear; direct fuel injection; pressurized lubrication system. Piston displacement: 3,611 c.c. (220·35 cu. in.). Maximum b.h.p.: 61·5 at 2,250 r.p.m. Fuel tank: 10 Imperial gallons. Alternative engines can be fitted.

Transmission: Torque converter transmission rigidly mounted and fully integrated for traction and driving auxiliaries, including single-stage torque converter, power-shift clutches for forward and reverse, with four-speed ranges in both driving directions. Torque converter stall ratio 2·35 : 1.

3

Fig. 3. Chaseside Loadmaster 3000 loading shovel commencing to demolish the air raid shelter

4

Fig. 4. Chaseside Loadmaster 3000 loading shovel half way through demolition of the air raid shelter, showing its excavator-like capacity for hard work

Axles: Heavy duty forged axle casings. Spiral bevel crownwheel and pinion. Epicyclic hub reduction.

Travel speeds, forward and reverse:

1st	2nd	3rd	4th	
4·45	6·4	12·1	20·4	m.p.h.
7·2	10·4	19·6	33	km.p.h.

Brakes: Four-wheel brakes, hydraulically operated, vacuum servo assisted. Hand brake, effective on axle input pinion.

Steering: Hydraulically assisted steering linkage.

Chassis: 8 in × 3½-in rolled steel channels employed for welded frame construction.

Hydraulics: Two lift jacks 5 in dia. Two scoop jacks 5 in dia. Identical wearing parts. Piston-rod pivots are fitted with replaceable spherical bearings, and cylinder pivots with replaceable carbon manganese bushes. Pump: gear-type, driven from transmission, 32½ Imperial g.p.m. at 2,250 r.p.m. Valve: open centre type with float plunger for side arm operation—relief pressure 1,200-1,250 lb/sq. in. Hydraulic tank of 14 Imperial gallons capacity houses a suction filter and magnetic filter. Strainer can be easily removed for cleaning and filter elements easily replaced without draining tank. Hydraulic lines: steel pipes of 1-in and ¾-in dia bore in conjunction with ¾-in dia bore flexible pipes.

Fig. 5. Chaseside Loadmaster 1000 loading shovel demonstrating its manœuvrability and controllability on rough ground

5

Side Arms: 1½-in thick steel plate members joined near front with heavy steel plate box section. All pivot points are bushed with replaceable carbon manganese steel bushes.

Scoop: Heavy steel plate of box-type construction and double skin base fitted with replaceable toe-plate sections in cast manganese steel. Digging teeth can be added. A special scoop is available for excavating rock or ore. Angle of scoop crowd: 45 deg; angle of tip at fully raised position: 45 deg. Maximum discharge height: 9 ft 6 in. Lifting time: 7½ seconds; tipping time: 2½ seconds.

Cab: The cab is arranged to give most comfort to operator and is fitted with a fully adjustable seat. The rear window can be opened, and side windows can be replaced by wire grids for extra ventilation in hot weather. For ease of entry and exit, the cab upper structure is mounted on special runners and rolls backwards.

Electrics: Twelve-volt equipment: 135-amp/hr capacity battery. Two beam lights facing forward, and one backwards for site working at night. Plug-in side lights and red rear lights are provided for travelling on highways, if required. Instrument lighting is provided.

Instrumentation: Engine oil pressure gauge; water temperature gauge; ammeter; vacuum gauge; hour recorder (fitted to engine); transmission oil temperature gauge; transmission oil pressure gauge.

Turning Radius: Nearest inside 12 ft 6 in, extreme outside 20 ft.

Weight empty: Front axle: 6,080 lb; rear axle: 8,570 lb; total: 14,650 lb.

Tyres: 14·00 × 24 × 8 ply.

Optional equipment: Quarry scoop; light-weight scoop; crane hook attachment; special cab fittings: heater; ventilator; demister; gauze side screens.

The Loadmaster 3000, shown in Figs. 2, 3 and 4, although basically similar in general design and construction, is altogether heavier and far more powerful and robust. Brief specification details are as follows:—

Engine: Six-cylinder four-stroke diesel engine, flexibly mounted; bore: 125 mm stroke: 130 mm; piston displacement: 9,572 c.c. (584·1 cu. in.); max. b.h.p.: 148 at 2,000 r.p.m.; compression ratio: 16:1; fuel injection equipment: C.A.V. with mechanical governor; fuel tank: 18 Imperial gallons (21·6 U.S. gallons). Alternative engines with similar characteristics may be fitted.

Transmission: Allison transmission rigidly mounted, comprising single-stage converter, three-speed each way epicyclic gearbox and transfer gear train integrated into one complete assembly. Full power-shift for speed changes in each direction. Clutches: metal plate type hydraulically operated. Oil cooler fitted.

Axles: Front and rear: Timken axles; hypoid crownwheel and pinion; epicyclic hub reduction.

Brakes: Four-wheel brakes, hydraulically operated; hydrovac boosted by exhauster fitted to engine; front: 16½ in × 5 in; rear: 17¼ in × 4 in. Transmission brake hand operated, fitted to transmission output shaft.

Steering: Hydraulically assisted steering linkage; handwheel: 18 in dia; hydraulic cylinder: 3 in dia; pressure: 800/1,000 lb/sq. in. Replaceable micronic filter in return line.

Chassis: 10 in × 3½-in and 12 in × 3½-in rolled steel channels employed for welded frame construction.

Hydraulics: Two lift jacks 7 in piston dia; two crowd jacks a 7 in piston dia; wearing spares are identical. Pump: gear-type, 66 Imperial g.p.m. at 2,000 engine r.p.m. Valve: open centre type with float plunger for side arm operation. Relief pressure—1,000/1,100 lb/sq. in. Hyd. tank of 32 Imperial gallons capacity houses a suction filter and also micronic high-pressure filter. A removable magnetic filter is fitted in the storage compartment. Hyd. lines: steel pipes of 1¼-in bore and flexible pipes of 1¼-in bore for main lines, and 1-in dia flexible pipes with swivel end fittings to jacks.

Side Arms: 2-in thick steel plate members joined near front with heavy steel plate box section. All pivot points are bushed with replaceable carbon manganese steel bushes.

Scoop: Heavy steel plate with box-type sectional construction at rear, and open double skin floor fitted with replaceable toe-plate sections in cast manganese steel. Digging teeth can be added.

Cab: Contains a soft, rigid, fully adjustable seat, a heavy-duty cab heater-ventilator unit, also supplies energy for demisting front, side, and rear windows. The rear window can be opened, and the cab be rolled back for entry and exit. Side windows can also be replaced by wire grids. Vacuum windscreen wiper is fitted.

Electrics: 24-V equipment, four lights facing forward and two to the rear; red rear lights are fitted. Instrument, cab lighting, and a plug for supplying detachable road lights are also provided. Battery storage capacity: 135 amp/hr.

Instrumentation: Scoop position indicator; engine oil pressure gauge; water temperature gauge; ammeter; vacuum gauge; engine revolution indicator; hour recorder (fitted to engine); transmission oil temperature gauge; transmission oil pressure gauge; fuel gauge.

Turning Radius (16.00 × 24 tyres): Nearest inside: 13 ft 0 in; extreme outside: 22 ft 8 in.

Scoop: Angle of crowd: 45 deg; angle of tip—fully raised position: 45 deg; maximum discharge height: 10 ft 2 in.

Maximum Lift Cycle: 8½ secs./2,000 r.p.m.

Nominal Scoop Capacity: 3 cu. yd.

Maximum Lift Force: 20,000 lb.

Maximum Pry-out Force: 22,500 lb.

Nominal Payload: 10,000 lb.

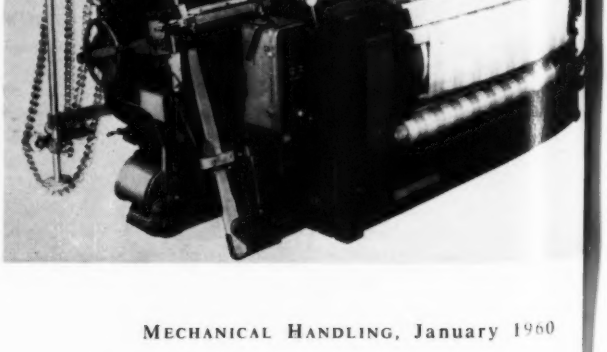
Axle Loads: Front 11,500 lb; rear 14,500 lb; total 26,000 lb.

Tyres: 18.00 × 25 × 16 ply high flotation sure grip; 16.00 × 24 × 16 ply hard rock lug; 16.00 × 24 × 12 ply light duty application.

Maximum Possible Traction at Stall: 27,800 lb.

Travel Speeds: Forward m.p.h.: 1st 3·6, 2nd 9·7, 3rd 27·0; reverse m.p.h.: 1st 3·7, 2nd 10·0, 3rd 28·0.

Fig. 6. A typical example of Northrop loom design, the MRT high speed loom for silk, rayon and synthetic yarns in general. The wide design and economic production 'knowhow', resulting from long experience of complex machinery such as that shown, enables the firm to undertake a very wide range of sub-contract manufacture



HANDLING WITH INDUSTRIAL TRUCKS

PART 4 — THE APPLICATION OF WORK STUDY TO INDUSTRIAL TRUCKS

By L. J. Hoefkens, A.I.Prod.E.

WORK STUDY is a simple title for a function of industrial management and its meaning is as simple as the two words of which it is composed. It means the study of work which is now being performed or of work which it is proposed to perform in the future with the object of obtaining greater efficiency.

A work study 'case' commences with the observation, checking and meticulous recording of every detail of the job being studied, including any associated paperwork, forms and routine. The operative word here is 'observation', which implies that the study must be made on the spot, on the shop floor, where the work is actually being performed. Composing a statement of how it was intended once that the work should be done can lead to erroneous conclusions, because, so often, what is actually happening on the shop floor is quite remote from what it is thought is taking place.

The next stage is a very thorough and critical examination of the record thus made with the object of eliminating any work that has been found to be unnecessary or unproductive. Then it may be possible to regroup or rearrange the remaining items of work to change their sequence or location in order to produce a more efficient flow of work or a better utilization of tools, plant and equipment. This examination is aided by posing the following sort of questions against each and every item of work or movement listed in the record. Why is the operation or movement necessary?; what real purpose does it serve?; is it being performed in the most suitable place, if not, where is the best place?; when is the best time to do it in relation to the other operations or movements?; who is the best-qualified person to do it, or who has the best opportunity to do it?; what is the best way that can be thought of to do the job?

Include in this analytical enquiry all materials, tools, equipment used, the design and flow of any associated paperwork, the layout, any safety aspects and, finally, the general housekeeping. In carrying out this approach to the study of work the result will often be found to be incomplete and inconclusive unless the amount of work performed at each stage is measured. Especially where several machines or operators are involved it is necessary to know the extent of each operation and periods of 'watching time' or 'idle time' so that by a better arrangement or sequencing these non-productive periods can be utilized and made productive as far as possible. This so-called 'phasing' of operations will produce efficient plant and equipment utilization. The foregoing two constituents of work study, namely method study and work measurement, must precede and form the basis for the introduction of any sound incentive scheme.

The technique of work study is not new, it has been known for many years, but like so many advances in industrial progress it has been adopted readily by a small number of companies to their great advantage, but, unfortunately, it was ignored by the majority. The economic forces of competition at home and abroad and the scarcity of labour are at long last compelling a widespread interest to be taken in work study by both managements and trade unions alike.

When thinking about management techniques such as incentive schemes, planning and loading, work flow or work study, they are usually considered purely in relation to machine shop or assembly shop activities. The work performed in transporting supplies to the factory, in receiving, handling and storing them, in moving materials between processes and, finally, in handling and despatching the finished product to the customer, is completely overlooked.

Method Study

With the advent of modern material handling methods and in particular the mechanical handling of materials by fork lift trucks and other power-driven industrial trucks, these very vital operations in the flow of work have become more akin to machine operations. Consequently, in the interest of economy of labour and space and a speedier 'throughput' of materials, it is essential that they receive the benefits of the same management techniques. Work study is no exception, and it is true to state that the full advantages to be gained by the employment of industrial trucks will not be realized unless the introduction of the new mechanical handling method is closely associated, right from the inception of the idea and in the planning stages, with the technique of work study. This statement is just as true whether the truck be used for warehouse work or whether it be integrated as part of an industrial process. Method study will indicate the best way to use the equipment and work measurement will give the answer to how much equipment is needed for a specific project.

When we are dealing with a machine tool we find that all the relevant basic data is readily obtainable. Its rates of feed, its range of speeds and so on are all known. Standard data regarding its output potential under a variety of conditions are all available, but when we come to extend work study to, say, fork lift trucks we realize that we are faced with a different problem altogether. Although we have in a fork lift truck a piece of mechanical equipment, there the similarity with a machine tool ceases, because the fork lift truck is mobile and its performance has to be measured under a number of different conditions which can vary from plant to plant or even within the same plant. Although the type of work performed by these trucks does vary considerably, which fact is proof of their tremendous flexibility and usefulness, nevertheless each job is made up of some or all of a definite number of basic movements, the sequence of which change from job to job as well as the number of times each movement occurs.

These basic movements are equivalent to the speeds and feeds of a machine tool, to come back again to the simile, and can be ascertained by observation and measurement under the actual working conditions of the factory or warehouse in question.

A normal operator or driver should be used during the work measurement study as well as a standard load. This latter could be the maximum permissible safe load for the truck as prescribed by the makers.

To quote an example let us take an industrial fork lift truck controlled by a seated driver. The truck has a lifting capacity of 4,000 lb, which it can raise to a height of 9 ft, and is fitted with 3-ft forks. The times recorded will, of course, vary, dependent on whether a petrol, diesel or electric battery-powered truck is used.

The basic movements are listed below and are divided into three groups: (*a*) movements associated with travelling; (*b*) movements associated with changes of direction; (*c*) movements associated with the manipulation of pallets.

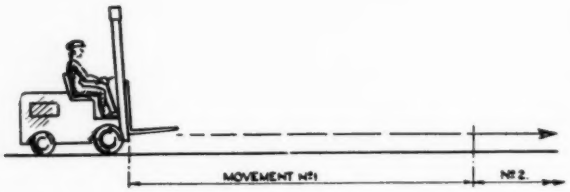


Fig. 1. Movement 1 and 2

Travelling Movements

(1) This movement covers the period during which the truck moves from the standstill position until it reaches its maximum permissible travelling speed.

(2) The forward speed measured in feet per second. This movement is calculated from the time the truck reaches its maximum permissible travelling speed at the end of the period of acceleration (No. 1) and ceases when the truck begins to slow down preparatory to stopping (No. 4).

Fig. 2. Movement 3 and 4

(3) The reverse speed measured in feet per second. The definition of which is the same as No. 2.

(4) This movement commences with the application of the brakes in order to bring the truck to the standstill position from its maximum travelling speed either in a forward (No. 2) or reverse (No. 3) direction.

Changes of Direction

(5) A right-angled change of forward movement to the right; usually associated with movement No. 2.

(6) A right-angled change of forward movement to the left; usually associated with movement No. 2.

(7) A right-angled change of backward movement to the right, usually associated with movement No. 3.

(8) A right-angled change of backward movement to the left, usually associated with movement No. 3.

(9) A right-angled change of forward movement to the right but at the end of the movement the truck comes immediately to the standstill position; usually associated with movements Nos. 2, 13, 14, 15 and 19.

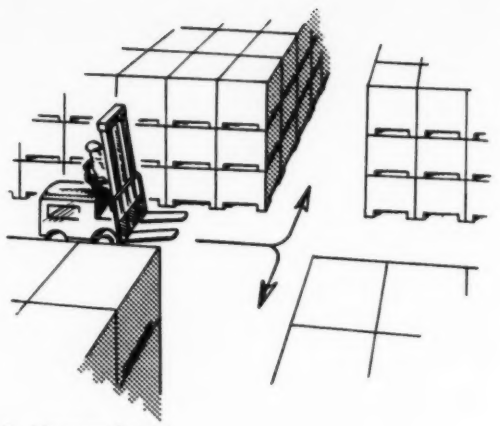


Fig. 3. Movement 5 and 6

(10) A right-angled change of forward movement to the left but at the end of the movement the truck comes immediately to the standstill position; usually associated with movements Nos. 2, 13, 14, 15 and 19.

(11) A right-angled change of backward movement to the right, but at the end of the movement the truck comes immediately to the standstill position; usually associated with movements Nos. 1, 16, 17, 18 and 20.

(12) A right-angled change of backward movement to the left, but at the end of the movement the truck comes immediately to the standstill position, usually associated with movements Nos. 1, 16, 17, 18 and 20.

Manipulation of Pallets

(13) This movement commences from the standstill position and includes the truck moving slowly forward a distance equal to the depth of the pallet to insert the forks in or under a pallet, or to place a pallet at ground level. It includes a slight raising or lowering of the forks and forward tilting.

(14) Identical to No. 13 but when it occurs at a height of one pallet.

(15) Identical to No. 13 but when it occurs at a height of two pallets.

(16) This movement commences from the standstill position and includes the truck moving slowly backwards a distance equal to the depth of the pallet to withdraw the forks from within or under a pallet, or to remove a pallet

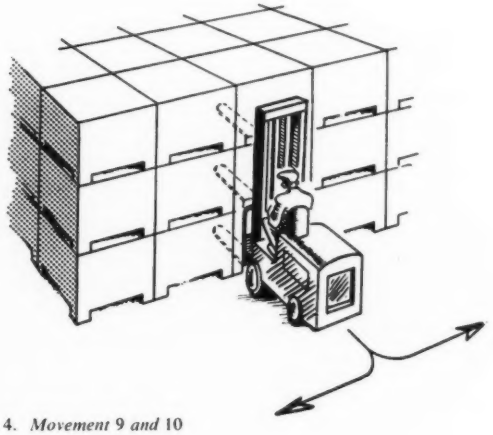


Fig. 4. Movement 9 and 10

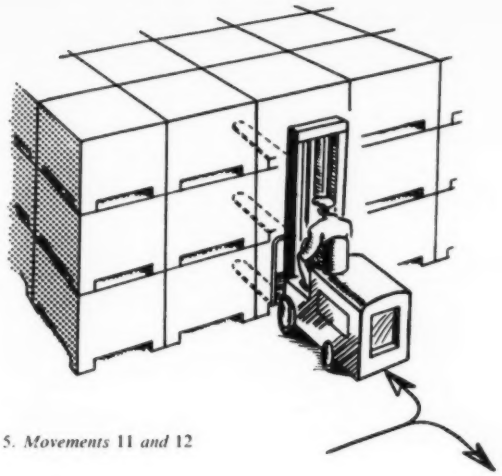


Fig. 5. Movements 11 *and* 12

at ground level. It includes a slight raising or lowering of the forks and backward tilting.

(17) Identical to No. 16 but when it occurs at a height of one pallet.

(18) Identical to No. 16 but when it occurs at a height of two pallets.

(19) The rate of raising the load with the truck in the standstill position, measured in inches per second.

(20) The rate of lowering the load with the truck in the standstill position, measured in inches per second.

By means of a combination of any of these basic fork truck movements any standard operation can be compiled and the basic time required to perform it can be accurately forecast. In cases where fork truck attachments such as rotary fork carriages or jib attachments are used, additional information must be acquired to complete the study. These times can be likened to what is known in machine tool work study practice as the 'floor-to-floor times', but in addition to these basic times, certain allowances will have to be made and contingency factors added in order to make the calculation realistic and bear a true relationship with actual working conditions.

Firstly, driving skill must be taken into account. The study should be made with an average operator who has been adequately trained. An allowance will have to be made to reflect the skill of all the drivers over and below this average if it is desired to know how many trucks are required for a particular project. An allowance must be made for fatigue and for personal needs during the day. Also must be taken into consideration tea breaks, truck-servicing times such as changing batteries, filling with petrol, etc. Most of these will be the standard practice in the company for other studies in machine or assembly shops.

Should the majority of operating distances be so small that the truck rarely runs at full speed, then cognisance must be taken of this factor.

If a fleet of trucks has been in operation for some considerable period, it will be possible to ascertain from the maintenance records the average delay time for breakdowns for which due allowance should be made. Allowances may also have to be made for working in very congested areas, for delays due to waiting for instructons, to abnormal road or surface conditions and the presence of doors which must be opened and closed by the driver.

If a frequently used stores aisle is narrower than the standard specified gangway used in the basic movement studies then a correction factor will have to be supplied to compensate for the loss of manœuvrability and speed. When laying out a palletized store it is usual to add 1 ft to the minimum specified distance for the truck to make a right-angle run in. This allowance will be considerable for every foot or fraction of a foot by which the gangway is reduced.

There could be other impedances to be taken into account such as gradients or places where for safety reasons a truck is required to halt before proceeding.

An example will now be given of a simple standard operation with a fork lift truck to illustrate how it can be broken down into these basic movements, see Fig. 8.

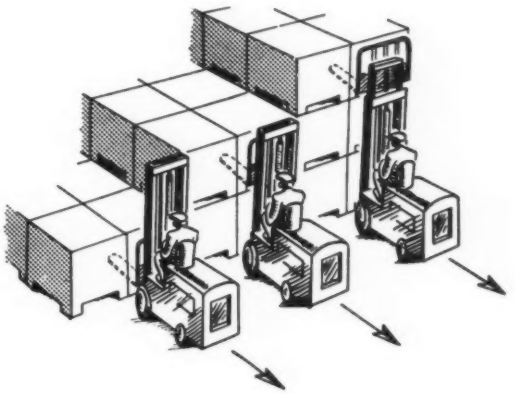


Fig. 7. Movement 16, 17 *and* 18

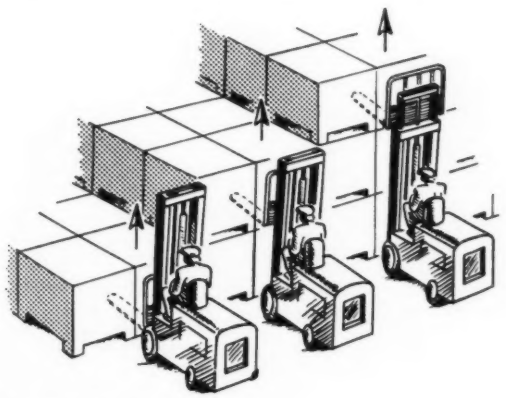


Fig. 6. Movement 13, 14 *and* 15

Job Description

A fork lift truck has to travel from point A, in a pallet store, to the end of an assembly conveyor B. There it picks up a full pallet P.1, and places it on top of an adjacent full pallet P.2, and returns with both pallets to the store and places them in a vacant location C in the pallet store and returns to the starting point D.

Basic Movements Performed

By reference to Fig. 8 the truck route is shown by arrowed lines, and against these lines are reference numerals corresponding to the movements taking place at that particular spot.

The fork truck commences from the standstill position at A and accelerates for 15 ft (No. 1); it then travels forward for 35 ft (No. 2), making a left-hand turn (No. 6) at the end of the gangway. It then travels forward for 40 ft (No. 2) and applies the brakes, coming to a standstill at the

doorway (No. 4). The driver dismounts and opens the door, remounts the truck and drives the truck through the doorway, halts, dismounts, closes the door, remounts the truck and proceeds (contingency allowance). The truck accelerates for 15 ft (No. 1) and travels forward for 35 ft (No. 2) followed by a left-hand turn (No. 6). It travels forward for a further 44 ft (No. 2) and makes a left-hand turn, coming to a halt in front of pallet P.1 (No. 10). The driver then lowers the forks slightly from the travelling position and tilts them forward and moves the truck forward, inserting the forks under the pallet (No. 13). The driver then raises the forks and loads to the travelling position, tilts the forks backwards and moves the truck backwards, withdrawing the pallet (No. 16). He immediately makes a left-hand turn in a backward direction (No. 12). Moving forward, a left-hand turn is made, coming to a standstill in front of pallet P.2 (No. 10). The forks and pallet P.1 are then raised to a height slightly above pallet No. 2 (No. 19). The truck is moved forward and the forks are tilted forward. They are then lowered slightly and pallet P.1 is placed on top of pallet P.2 (No. 14). The truck then moves in reverse to withdraw the forks from under pallet P.1 (No. 17). The forks are lowered to ground level (No. 20) and the truck moves forward and inserts the forks under pallet P.2 (No. 13). The forks are then raised to the travelling position, tilted backwards, and the truck and the load of two stacked pallets is drawn backwards (No. 16). A right-hand backward turn is made and the truck comes to a standstill position (No. 11). The truck then accelerates for 15 ft (No. 1) and continues travelling forward for 35 ft (No. 2), making a right-hand turn (No. 5) into the main gangway, proceeds for a further 40 ft (No. 2), applying the brake and coming to a standstill in front of the door (No. 4). The opening and closing of the door is repeated as on the outward journey (contingency allowance). The truck accelerates for 15 ft (No. 1), travels forward for 35 ft (No. 2), followed by a right-hand turn (No. 5) into the pallet store. It travels a further 25 ft (No. 2) and makes a right-hand turn, coming to a standstill in front of the empty location C (No. 9). The truck then moves forward and places the pallets in the vacant space by tilting the mast forward and lowering the forks (No. 13). The forks are withdrawn from under the pallet, they are raised to the travelling position and tilted backward (No. 16). A left-hand backward turn is made (No. 6). The truck accelerates for 15 ft (No. 1), the brakes are applied and it comes to a standstill at D, where the cycle of operations commenced (No. 4).

A summary of these operations is shown below and for the purpose of explanation a hypothetical value has been given to each movement.

Summary of Movements

Reference No.	Occurrences	Time in seconds
No. 1	5	15
No. 2	289 ft	60
No. 4	3	6
No. 5	2	6
No. 6	3	9
No. 9	1	4
No. 10	2	8
No. 11	1	5
No. 12	1	5
No. 13	3	15
No. 14	1	6
No. 16	3	11
No. 17	1	5
No. 19	36 in	6
No. 20	36 in	4
		165 seconds

This time of 165 seconds for one cycle of operations is the minimum nett time to which must now be added certain contingency allowances which, again for the purposes of explanation, are purely hypothetical.

Doorways

The door had to be opened and closed twice during this cycle, which took some 90 seconds, therefore an allowance must be added of 54 per cent.

Personal

In this case the allowances made are to cover personal needs, tea breaks, clocking allowances, fatigue, etc., and are of the order of 8 per cent.

Maintenance

An allowance must be made in respect of time taken to replenish the truck with fuel or changing batteries, checking tyre pressure and also for average down-time for running repairs. This latter figure should be obtained from the maintenance records, say, 5 per cent.

To the basic times for this particular study must be added a total contingency allowance of 67 per cent to the 165 seconds, making a total standard time of 275 seconds or 4 minutes 35 seconds. Therefore the truck could be expected to make 13 journeys per hour and to transport 26 full pallets or, conversely, if the assembly track output filled 52 pallets per hour, then two such trucks would be necessary. This information is derived from work measurement, but method study will indicate that for almost half of the cycle the truck is running empty, i.e. when travelling from the store to the assembly track. Therefore in order to obtain maximum utilization of equipment, work will be sought in order to fill this unproductive part of the work cycle. In this case it would no doubt be arranged for the truck to replenish the assembly track with empty pallets. In other instances a possible combination of jobs would be investigated so that by making a truck route, to incorporate other work, it would be employed with the maximum efficiency.

Under other circumstances further contingencies will be met with for which due allowances must be made. It is by the critical examination of these allowances, some of which can be inefficiencies, and by comparing them with the basic movement time that scope will be found for improvements. The application of work study principles will provide the answers.

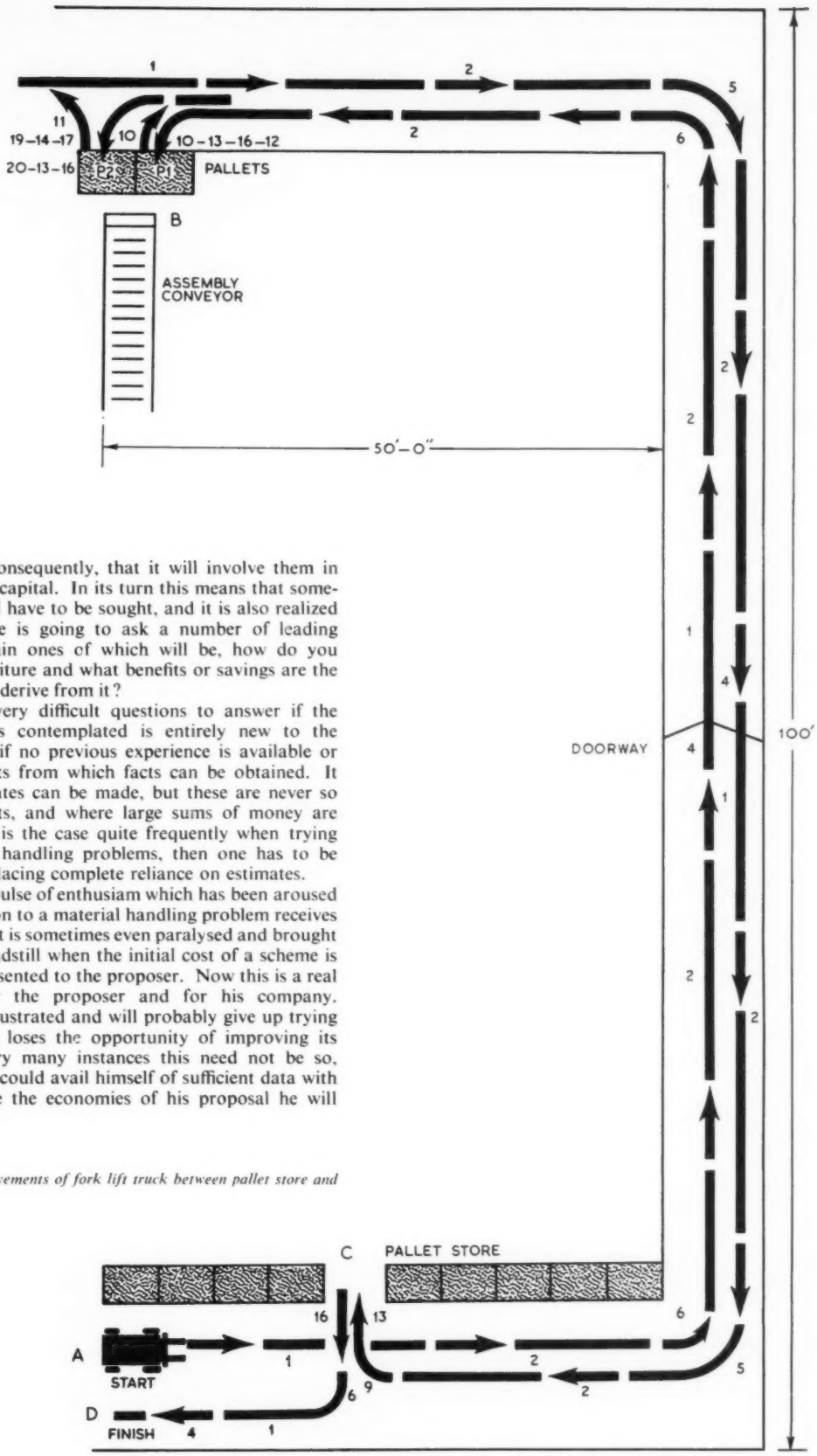
When the basic movement times and allowances have been established by work measurement in a particular factory or warehouse, this information can be readily used in conjunction with work study cases in connection with any fork truck activity now taking place or being planned for the future. It is essential for the justification of the purchase of additional equipment.

Although the example given deals with work performed by a fork lift truck, the same principles of work study, namely work measurement and method study, can be applied to any type of industrial truck.

New Equipment Justification

This section has been included to suggest a solution to the many questions asked on this subject by numerous persons from diverse industries at meetings, lectures and conferences. To add conviction and weight to its context some examples from practice have been included.

More and more people are being made aware and are being convinced that they should adopt the latest means open to them to reduce their overhead costs, and consequently their selling prices, by modernizing the handling of materials throughout their organizations. In many cases they appreciate that this will entail the purchase of new



equipment and, consequently, that it will involve them in an expenditure of capital. In its turn this means that someone's sanction will have to be sought, and it is also realized that that someone is going to ask a number of leading questions, the main ones of which will be, how do you justify this expenditure and what benefits or savings are the company going to derive from it?

These can be very difficult questions to answer if the equipment that is contemplated is entirely new to the organization and if no previous experience is available or no precedent exists from which facts can be obtained. It is true that estimates can be made, but these are never so convincing as facts, and where large sums of money are involved, such as is the case quite frequently when trying to solve material handling problems, then one has to be very cautious in placing complete reliance on estimates.

Many a first impulse of enthusiam which has been aroused in finding a solution to a material handling problem receives a very nasty jolt. It is sometimes even paralysed and brought to a complete standstill when the initial cost of a scheme is calculated and presented to the proposer. Now this is a real tragedy both for the proposer and for his company. He himself feels frustrated and will probably give up trying and the company loses the opportunity of improving its efficiency. In very many instances this need not be so, because if only he could avail himself of sufficient data with which to calculate the economies of his proposal he will

Fig. 8. Route and movements of fork lift truck between pallet store and assembley conveyor

frequently find it relatively simple to make out a very strong case to support a new method with new equipment, particularly when the flexibility and the material-moving capacity of modern handling equipment is borne in mind by comparison with the old methods which are still being used to-day in so many factories, stores and warehouses.

The first vital information which is needed is the knowledge of what is happening to-day; how are we doing the job now; what equipment, if any, are we using and how long does it take to perform a given job? The answers to these questions can only be found by a detailed, meticulous 'on-the-spot' study, by observation, by timing and by listing every relevant operation that is performed, every paperwork recording that is made and every handling that takes place, and tabulating these findings exactly as they are seen to occur.

Now, in the larger organizations who are fortunate enough to possess a work-study expert, this presents no problem at all; it is part of his function. The information can be obtained if the required time is spent on the job. But, where such a service does not exist then the manager concerned or some other competent person must undertake to carry out this study which is the essential first step. Any other course can only lead to amateurish or half-hearted results.

Without such a detailed knowledge of the existing methods, procedures and practices, no sound opinion can be formed or correct decision made regarding a new method. It is not even possible to decide whether a new method is practicable or possible. On the other hand, however, when armed with this information, presented in a clear and logical manner, one is able to reach a definite decision whether or not a new method can be adopted to advantage.

Practical difficulties then loom up very formidably in the mind of the planner because in all probability he will have had no experience of the type of equipment he is considering using and, there being no precedent within the organization, he finds it difficult to assess precisely how it will work, what it will cost to operate, what it will save and what are the problems he will have to overcome before and after its introduction.

To keep faith with the title of this series of articles let us suppose it is decided to use a fork lift truck for certain handling work, then, very obviously, the cost of purchasing the truck will have to be substantiated and immediately the question arises, 'How much does it cost to run such a truck per year?' Following very swiftly on the last question comes the next one, 'As we do not possess such a truck how do we find out?' A very real problem indeed if the job is being taken seriously and it is intended to ensure that the capital outlay is recovered and the new method is going to be a paying proposition. A 'happy-go-lucky' attitude towards these matters is not good enough. It has been known for a top executive of a company to purchase such a truck because he thought that it was the right thing to have nowadays. He had read reports and advertisements extolling their 'cost-cutting' potential. As a matter of fact he had seen one at work on a television programme and it was quite obvious to him that such a machine was quicker than manual labour and that, therefore, he knew that it was bound to pay for itself. Such enthusiasm is most praiseworthy, but of itself insufficient, for how did he know he would obtain a good return for his capital investment, or how did he know how much it would save in manpower or perhaps, even, he should have bought two trucks? It is like filling a kitchen with gadgets that will save time but, in fact, save no money, as it is found that you still have to pay the same cook at the end of the week. Industrial economics must be based on surer foundations if they are to survive the penetrating scrutiny of accountants and boards of directors who are only interested in proposals for sound capital investments. Materials handling equipment is now established as a tool of industry; it must therefore earn its keep in precisely the same manner and for the same reasons as machine tools and other pieces of plant.

Continuing then with the comparison between a machine tool and a piece of material handling equipment, let us return to the fork lift truck, which was taken as our example. We find that we can obtain all the relevant data required concerning the machine tool. Its rates of feed, its range of speeds and so on, are all known. We can also obtain standard data regarding its output under a variety of conditions; in fact very accurate calculations can be made before the acquisition of such a piece of plant, to indicate exactly what the economics are, so that a proposal to purchase a machine tool can be adequately substantiated and justified, and ultimately its performance achievement can be measured and compared with the data contained in the proposal. But how do we stand with our fork lift truck? The only published information is that supplied by the manufacturer of the truck and is in very broad terms, and it is usual to find that any figures of performance tend very naturally to be weighted on the conservative side as a safeguard against possible customer reaction. What are really needed, however, by the planning or materials handling engineer, are figures and charts showing, for instance, the times taken to perform the basic movements when empty and with certain loads, e.g. straight runs, stacking 6 ft or 9 ft, running out from a 6-ft or 9-ft stack, tilt forward and backward, etc., also allowances for certain working conditions, e.g. passing through a door, operator fatigue, battery fatigue, etc. Such information will enable him to arrive at the number of trucks he will require for a specific project and later to measure their operational efficiency. Next he will require to know the operating costs. There are now enough trucks in use, many of which have been at work for a sufficient period, to enable facts and figures to be accumulated to provide such information with a considerable degree of reliability.

As examples of some of the information that is needed it might be helpful to quote from actual experience gained after five years' intense usage. To obtain, for instance, the running cost of a 2-ton electric driver controlled fork lift truck the following information has been used:—

Cost of electricity to charge batteries	3·6d per hour
Cost of repair materials used	13·2d per hour
Cost of maintenance labour	6·4d per hour
Overhead expense on mechanics and workshop	6·1d per hour
Depreciation	26·7d per hour
	56·0d per hour

These figures are based on an average over a fleet of 25 similar trucks, varying in age up to six years. An hourly cost is calculated because of the considerable difference in working hours of individual trucks due to shift working by some of the fleet. It should be noted that the cost of depreciation is the highest single factor. This will vary from company to company according to policy and for comparison purposes should be omitted. Items of cost such as these can only be obtained after several years of operating and of keeping accurate records for cost purposes.

The cost of running such a truck excluding the driver's wages and National Insurance amounts to 4s. 8d. per hour. Therefore rather than being dismayed at the thoughts of having to ask for an expenditure of a substantial sum of capital, it should be realized that we have only to justify an economy of 4s. 8d. per hour to break even and that any saving in excess of this is profit.

A simple operating example will illustrate how such a

calculation can be made. Small rough castings are delivered by a foundry in a lorry which takes 276 man/min to unload and to place the castings in containers. These containers are on a stand which can be moved by a petrol platform truck. On arrival in the store the castings are taken out of the containers by hand and are either stacked on the floor or are placed into bins.

An improved method can have two alternatives—

(*a*) The lorry can come in with the castings already in pallets or stacking containers and then a fork lift truck can can take two pallets at a time to the store and stack them in the store.

(*b*) The castings can still arrive loose on the lorry as before and be manually unloaded into pallets or stacking containers and then be transported two at a time and stacked in the store.

Present Method

1. Unload by hand a lorry loaded with small loose castings into 12 containers at the side of the lorry

12 containers = 276 man/min

Cost = 23s. 5d.

Manual labour is taken at 5s. 1d. per hour therefore 276 man/min is equal to

$$\frac{61}{60} \times 276 = 280.6\text{d.} = 23\text{s. } 5\text{d.}$$

2. Industrial elevating platform truck picks up the 12 containers singly, transports them 50 ft and deposits containers and returns to lorry.

12 × 1 min journey = 12 platform truck/min

Cost = 1s. 6d.

Platform truck/min = truck running costs plus labour cost.

3. Loose castings are taken manually out of the containers and are stacked on the floor.

12 containers = 276 man/min

Cost = 23s. 5d.

Total cost = 48s. 4d.

New Method

(*a*) 1. Fork truck unloads 12 pallets from lorry, two at a time, places them on the ground at the side of the lorry.

3½ fork truck/min

Cost = 7d.

Fork truck/min = cost of running fork truck at 4s. 8d. per hour plus driver's total pay which makes a total cost of 10s. 2d.

$$3\tfrac{1}{2} \text{ fork truck/min} = \frac{122}{60} \times 3{\cdot}5 = 7{\cdot}1\text{d.}$$

2. Fork truck picks up two containers at a time, travels 50 ft and stacks them in the store and returns to lorry.

7 fork truck/min

Cost = 1s. 3d.

Total cost = 1s. 10d.

(*b*) 1. Unload by hand a lorry with small loose castings into containers at the side of the lorry.

12 containers = 276 man/min

Cost = 23s. 5d.

2. Fork truck picks up two containers at a time, travels 50 ft and stacks them in the store and returns to the lorry.

7 fork truck/min

Cost = 1s. 3d.

Total cost = 24s. 8d.

Fork truck/min = fork truck cost plus labour cost. Items (*a*) 1 and (*a*) 2 and (*b*) 2 can be obtained easily enough if one has already a fork truck in operation, but they could be compiled from standard operation and movement data if such were in existence. In these calculations manual labour has been taken at 5s. 1d. per hour and fork truck driving at 5s. 6d. per hour. These rates must be substituted by the rates prevailing in the particular circumstances of the reader.

The cost of performing this operation of unloading the lorry and getting the material into the store by the present manual method with platform truck costs 48s. 4d., whereas alternative method (*a*) by fork lift truck costs only 1s. 10d., and alternative method (*b*) partly manual and partly mechanical costs 24s. 8d. The savings per lorry load are then with alternative method (*a*) 46s. 6d. and with method (*b*) 23s. 8d.

Alternative (*a*) is obviously the better method and produces the greatest economies. It is also the easiest to operate because the work is continuous for one person, whereas with method (*b*) the fork truck must have other work to do or at least its driver, in order to avoid idle time. This does not infer that the truck is only justified provided it can be guaranteed full employment. With new method (*a*) it can be shown that the break-even point between the proposed method and the present method is at about 9 minutes activity per day or 10 pallets. If the truck is used for this period then only 9 minutes of the driver's time is included in the calculation, but it does include the full day's running cost and depreciation. It could be argued here that only 9 minutes of the electricity consumption should be included which is, of course correct, but this figure is negligible and can be ignored in this instance. The driver must have alternative work to warrant such a calculation.

Let us now assume that, in addition, a quantity of 300 pallets is required to operate the scheme, then approximately another £3,000 capital expenditure will have to be justified. Therefore the extra cost is as follows:

Depreciation (complete amortization in 10 years)	£300
Repair labour	£100
Repair materials	£50
Overheads on labour and repair shop	£100
Total annual cost	£550

This works out at a further cost of 5s. per hour. The break-even point with the total system is now about 10 minutes' work with the fork lift truck and an intake of 11 pallets or less than one lorry load per day.

This, then, is an example in its simplest form. Other complications arise such as, for instance, if a store is to be expanded then the cost of purchasing other equipment such as storage racks or bins, cranes, hoists, etc., and installation charges must be offset against the purchase price of pallets as the alternative. We have seen that in this example the fork truck will only be needed for part of the day for unloading incoming vehicles as also would a crane or hoist, but the fork truck has the advantage that, being mobile, other work can be found for it, which will all help.

Taking of the pallets out of the store and delivering them to a machine or process shop as the justification of a proposal would again show appreciable savings against manhandling the components out of bins or picking them up from floor stacks.

So far, any saving of space, a quicker turn-round time of vehicles, the elimination of damage to materials and the fatigue of personnel has been omitted, but if any of these factors is calculable and substantial then they should be included. With a labour rate of 5s. 1d. per hour it really means that to justify a truck costing 4s. 8d. per hour to run the labour of less than one man has to be saved or 41 hours per week; if the 500 pallets are included it works out to just a little less than two men. Anything saved over and above this is clear profit. These examples have been quoted to show the type of calculation that is needed and that the task of proving the economics of a case is not so formidable as is sometimes imagined.

A New Development in Belting

INTRODUCING BUTYL RUBBER

by A. G. Strong, M.Sc.*

At the I.C.I. phosphate plant at Billingham rubber belts are extensively used to convey granular fertilizer during the various stages of processing. At one stage of the operations the fertilizer, at a temperature of 230 deg F, is transported up a steep gradient at a rate of 220 ft/min and under these conditions the average life of a belt, based on natural or conventional synthetic rubbers, has been twelve months. At first the rubber hardened and then cracked so that the hot fertilizer penetrated the fabric reinforcement, causing ultimate failure.

A Butyl rubber-covered cotton conveyor belt was then installed and has now been in continuous service for three years; this is shown in operation in Fig. 1. It has been stated that the belt is as 'flexible and pliable as when it was fitted' and it has been estimated that transportation costs have been halved. This experience prompts the questions: what is Butyl rubber, what are its properties and why are Butyl conveyor belts not generally available?

* Esso Petroleum Company, Limited, Chemicals Department.

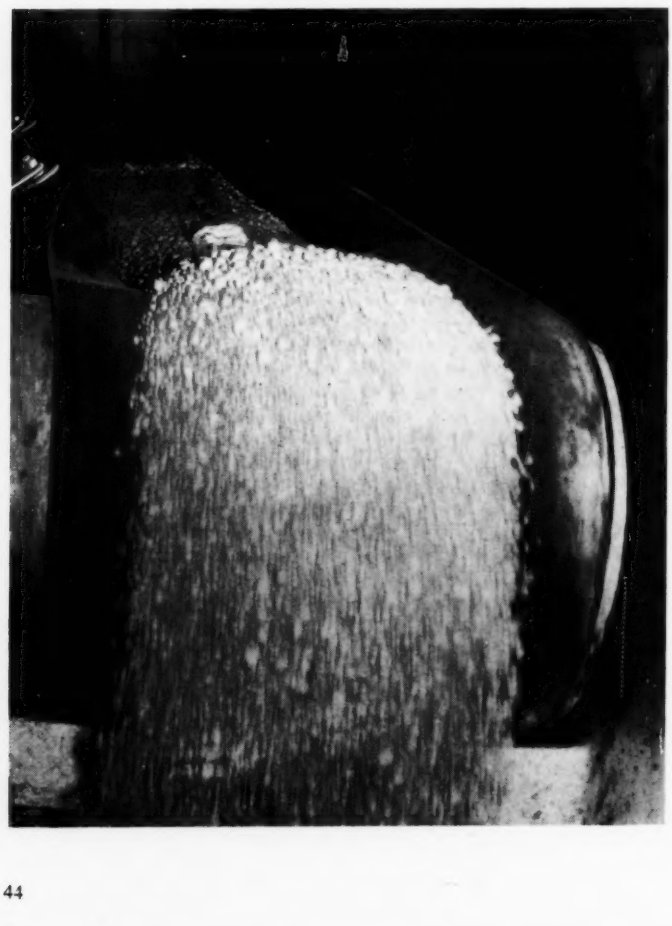


Fig. 1. Butyl conveyor belt transporting hot granular fertilizer in the I.C.I. phosphate plant

What is Butyl Rubber?

Butyl rubber was discovered by Dr. Sparks and Dr. Thomas of the Esso Research and Engineering Company Laboratories in the United States in 1937 in a research programme to develop a form of synthetic rubber which would not deteriorate in service. It is well known that natural rubber and synthetic rubber, SBR, which came into prominence during the war, are subject to perishing on exposure to the atmosphere or oxidizing conditions.

Butyl rubber was manufactured by reacting two refinery gases, isobutylene and isoprene, together under specific conditions and was soon shown to be resistant to atmospheric ageing, corrosive chemicals and heat. Since the physical properties of a rubber are related to its chemical structure it is not surprising that Butyl rubber also exhibited other unique characteristics which included shock- and sound-absorption properties, negligible water absorption and therefore excellent electrical characteristics and finally low gas and vapour permeability. As the air impermeability of Butyl rubber is ten times better than other conventional rubbers, chemical plants were immediately constructed in the United States and Canada for the manufacture of Butyl for use in inner tubes, and in Great Britain to-day most inner tubes are made of Butyl rubber. Thus, unwittingly, most road users have had some experience of Butyl rubber!

Properties

Butyl rubber has many applications and the development work has progressed in all directions. Since tyres consume the major quantities of rubber a considerable effort has been made to promote the manufacture of Butyl tyres and the recent marketing of the Butyl rubber tyre in the United States indicates the success of this undertaking. Much of the experience gained in this work is directly related to the manufacture of conveyor belts since both are composite structures with fabric reinforcement requiring good ageing, flex resistance and, of paramount importance, good abrasion characteristics. In view of this and the fact that the requirements of tyres are universally appreciated, the proper-

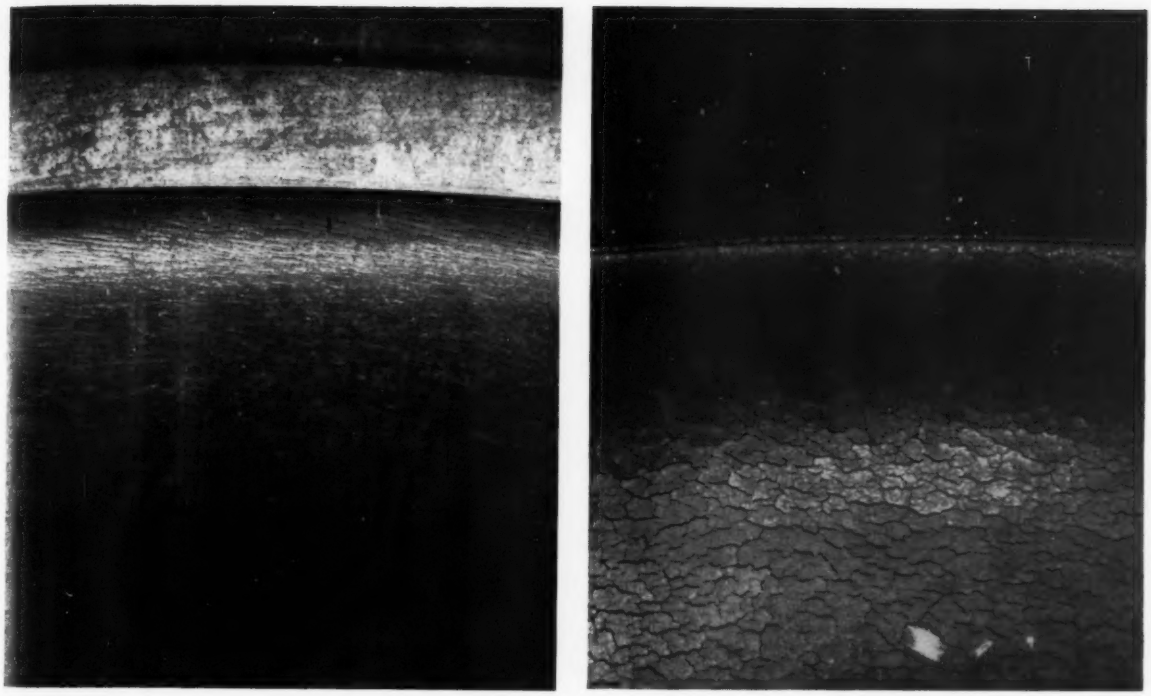


Fig. 2. Comparative resistance of Butyl and SBR tyre side-walls to atmospheric deterioration. (Left) Enjay Butyl, (Right) SBR

ties of Butyl rubber conveyor belts are discussed analogously with Butyl tyres wherever possible.

Foremost of the properties of Butyl rubber is its inherent resistance to perishing, which is unmatched by conventional rubbers. Although protective agents can be added to natural rubber or SBR to strengthen their resistance to ageing, the relief is only temporary. Butyl requires no such agents to enhance its resistance. Fig. 2. compares the familiar sidewall cracking of a conventional tyre with a Butyl tyre after similar exposure. The resistance to perishing also contributes to good flex life of Butyl components.

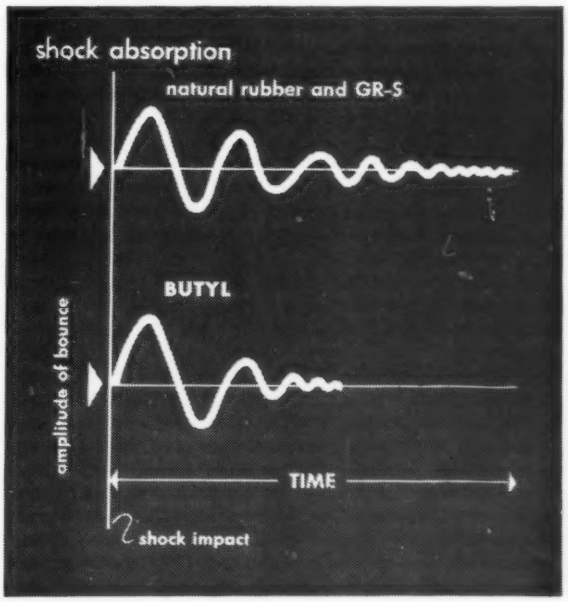
The heat resistance of Butyl is illustrated by the fact that accepted laboratory ageing tests for rubbers have been amended since they could not detect compounding differences. The specified ageing temperatures have been increased from 158 and 212 deg F to 250 and 300 deg F. A further indication of the heat resistance of Butyl rubber is that the operating temperature for Butyl rubber-insulated cables has been specified to be 48 deg F higher than conventional rubber cables. For belting applications, indefinite service life at temperatures up to 250 deg F has been claimed and by modifying the compound this figure can be extended to 300 deg F. Peak-load temperatures up to 450 deg F have been met. It is therefore seen that the I.C.I. experience with Butyl conveyor belts is not unexpected.

The relative chemical resistance of a number of rubbers is compared in Table 1 and it is seen that Butyl has superior resistance to acids and alkalis. However, Butyl is neither oil nor fire resistant and in this respect is identical to natural rubber.

The shock-absorption characteristics are illustrated in Fig. 3. Butyl lacks the resilience and snap of natural rubber and therefore absorbs the energy rather than dissipates it as rebound. The damping action is clearly depicted in the diagram. Thus Butyl components make excellent shock absorbers and vibration isolators and these features contribute to superior riding comfort which Butyl tyres offer.

Generally speaking, Butyl components are not as hard as the rubbers which they replace and, contrary to expectation, this feature enhances their abrasion resistance. This can be explained, since Butyl can deform around an abrasive particle, whereas a harder rubber cannot do so, with the result that scoring and tearing ensue. This is shown in Fig. 4 by illustrating the grip of a conventional rubber and

Fig. 3. The improved damping action of Butyl is most marked



ORDINARY TYRE

BUCRON TYRE

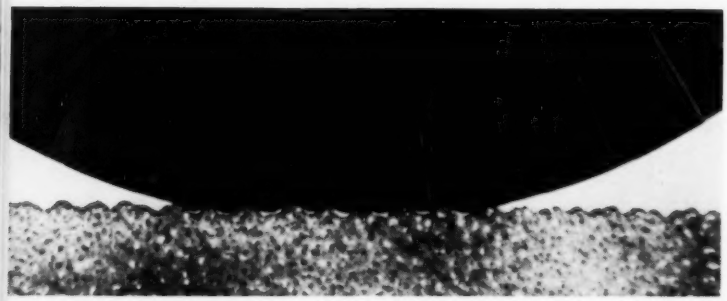


Fig. 4. Representation of the greater contact surface area of Butyl rubber compared with SBR

Butyl tyre on a magnified road surface. There is greater surface contact with Butyl rubber so that improved traction, road holding and braking ability result. This latter property is most apparent on wet surfaces. Therefore, improved traction in transporting granular, rough and particularly wet loads by Butyl conveyor belting follows directly.

Development of Conveyor Belts

The reason why Butyl rubber conveyor belts have not been generally exploited earlier is complex. A rubber with totally different properties demands a totally different technology of manufacture and whilst the bulk of Butyl rubber was being manufactured at the United States Government-owned plants for inner tube production, rubber manufacturers had little incentive to develop this material for other applications. In this country the restricted supplies of Butyl rubber were a further deterrent.

Over the last few years this position has radically altered, the plants have been sold by the United States Government and supplies of Butyl from North America are readily available. Moreover, belting manufacturers have developed the technology required to produce Butyl conveyor belts. In view of the growing demand for Butyl rubber, Esso Petroleum Co. have undertaken to build a plant at their Fawley refinery when demand justifies it.

Ironically, the technological problems which required to be overcome follow directly from the features which make Butyl attractive. For example, the chemical inertness of the rubber makes fabric adhesion and the vulcanization process more difficult. New techniques have been developed to streamline these manufacturing operations and to overcome the entrapment of air which can easily occur due to the impermeability of the rubber. The manufacture and widespread marketing of Butyl tyres on a commercial scale in the United States demonstrates that these problems have been overcome.

Although Butyl rubber is cheaper than natural rubber and SBR, additional compounding costs make the belting slightly more expensive. The I.C.I. have demonstrated that this premium is well justified in terms of reduced transportation costs and it is expected that as more belting suppliers gain manufacturing experience the price will be reduced. Butyl conveyor belting based on nylon or terylene fabrics is available for heat-resistant applications.

It has been shown that conveyor belting based on Butyl rubber can extend the range of applications of rubber belting and give longer service life. Those companies using Butyl belting envisage a considerable expansion of applications over the next few years.

Table 1. Chemical Resistance of Butyl, Natural and Nitrile Rubbers

Fluid	POLYMER Butyl	Natural	Nitrile
acetone	E	E	P
acids	E	E	G
alcohols, ethyl	E	E	E
isopropyl	E	E	E
amyl	E	E	E
bensyl	E	E	E
alkalis	E	E	G
analine	E	P	P
animal oils and fats	E	P	G
benzene	P	P	G
butyl acetate	E	P	G
butane	P	P	E
carbon disulfide	P	P	G
carbon tetrachloride	P	P	P
chloroform	P	P	P
cottonseed oil	E	P	E
M-cresol	E	E	E
dibutyl phthalate	G	G	P
diethylene glycol	E	E	E
dioctyl phthalate	G	G	P
ethyl acetate	E	G	G
ethylene glycol	E	E	E
ferric chloride	E	P	P
furfural	E	E	G
gasoline	P	P	E
glycerine	E	E	E
N-heptane	P	P	E
hexane	P	P	E
hexane	P	P	E
linseed oil	E	P	E
mineral oil	P	P	E
naphtha petroleum	P	P	E
nitrobenzene	E	G	P
iso-actane	P	P	E
ozone	E	P	P
phenol	E	E	G
phosphoric acid	E	P	P
propane	P	P	E
Skydrol	E	P	P
Skydrol 500	E	P	P
toluene	P	P	E
tri-cresyl-phosphate	E	P	P
turpentine	P	P	E
vegetable oils	E	P	G
xylene	P	P	E

E – excellent for service in this fluid
G – fair to good for service in this fluid
P – poor for service in this fluid

SELLING TO WESTERN GERMANY

By J. A. M. Marjoribanks

H.M. Minister (Economic), British Embassy, Bonn

I would like to suggest to every trader and manufacturer reading this journal that they should take another look at the possibilities of Western Germany as a market for their goods. If you are already exporting to this market I would like you to consider whether you can do more. If you are not, then I suggest it would be worth your while thinking seriously about making a start. I suggest this for three reasons.

In the first place the idea that exporting to Germany is like sending coals to Newcastle is untrue. The facts prove it. Imports into Western Germany from the United Kingdom in 1957 totalled some £97 million—over half of this industrial goods. In the first eight months of 1959 these imports had risen to an annual rate of £135 million. Western Germany is now, in fact, the United Kingdom's largest export market outside North America and the Commonwealth, and between 1956 and 1958 our exports to Western Germany expanded more rapidly than to any other major market. There is therefore money to be made in Western Germany.

In particular, Germany offers a large and growing market for mechanical handling equipment. This at first sight may seem odd. The West German mechanical handling industry produces a wide range of handling equipment both in the battery-operated range and in the range propelled by internal-combustion engines, particularly diesels, which have found favour lately on grounds of economy, in fork lift trucks, with a tendency towards 2-ton trucks, battery-propelled stackers with a capacity of 1 to 2 tons in weight and up to 16 ft in height, fixed-platform trucks with loading capacities from 660-2,205 lb, pole-steered lifting trucks, jack transporters, pedestrian controlled with hydraulic hoisting and lifting devices, works and factory tractors together with a wide range of equipment for use with tractors and battery- and diesel-propelled heavy-duty trucks. But, at the same time, the demand for this equipment in Germany has been, and is, growing steadily.

Unemployment in Germany rose slightly in October compared with September, but is still below 200,000 and it is the second-lowest figure in the history of the Federal Republic. This had led to an increasing demand in Germany for rationalization, automation and for capital equipment. Some of this has been reflected in the increase of 20 per cent this year in German imports of British lifting and handling machinery and conveyors, a rise from DM 3.5 million in the first eight months of 1958 to DM 4.3 million in the first eight months of 1959, and in addition to this rising import trend there is obviously a premium for special features of design, outstanding quality and competitive price.

The best way to assess these is to exhibit at the annual German Industries' Fair at Hanover, April 24th-May 3rd, 1960. Here, the interested United Kingdom exporter can size up the range of equipment popular in Western Germany and can also make contacts with German manufacturers who might be interested in manufacturing in Western Germany under licence. But even for the manufacturer who wishes to export his equipment to Germany, there is a considerable future for those firms who are prepared to study German requirements at the Hanover Fair, to offer competitive features in quality, design and price, and adequate servicing facilities, combined with advertising in the trade press and the provision of well-produced and well-written literature in German. In a paragraph, of course, it is not possible thoroughly to outline the detailed possibilities for mechanical handling equipment in Germany, but a market report on this has been produced which can be obtained from the Export Services Branch of the Board of Trade at Lacon House, Theobalds Road, London, W.C.1.

In the second place there is the future of our trading relationship with Europe. It is, of course, far from certain. On the one hand, there is the prospect that Germany's membership of the Common Market will cause discriminatory tariffs against our goods. On the other hand, there is the more hopeful prospect that the formation of the European Free Trade Association will be followed by a wider association of the O.E.E.C. countries including, of course, Western Germany. In either case, the sooner we take the measure of German competition the better; and this can only be done in the German market itself. Whatever happens in Europe we cannot afford to lose touch with its biggest and most rapidly growing market.

Finding Agents

In the third place, you may be uncertain about how best to set about the West German market and may not know of the assistance we here can give you. To help find agents for British firms and assess market possibilities, we have full-time commercial officers in Düsseldorf, Hamburg, Bremen, Hanover, Frankfurt, Stuttgart, Munich and West Berlin; these officers have detailed knowledge of local conditions and openings and are well placed to give advice to British exporters. We are linked with all these posts by a teleprinter network; between us we are handling well over a hundred requests a week from British firms seeking agents or information about the West German market; in addition to dealing with this steady stream of specific requests, we send back to the Board of Trade every month a detailed report on economic developments in Western Germany; we also make a number of appreciations of market possibilities for particular lines of British goods such as the one I have mentioned in mechanical handling equipment. We do not claim to be experts—we handle enquiries for all lines of goods—and our resources are far from unlimited. And you know as well as I do that finding a good agent is often a lengthy and difficult job. But we can give you advice based on local knowledge; we should like you to know of it and we hope you will use it.

These are, to my mind, good reasons for tackling the West German market. Success here is of course not easy. Western Germany is a highly competitive market and it would be misleading of me to guarantee, in every case, success. But I believe that British industry has a great deal to offer which is second to none. One proof of this is the fact that our exports of manufactured goods to Western Germany have increased over fourfold over the last five years. So I very much hope that in the light of the facts I have given you will think hard about Western Germany as a market. If you would like any information on particular points we should be only too happy to try and get it for you. And if you would like us to try and find an agent for you, we shall also do our best. In that case you should let us have two dozen copies of some descriptive literature and

prices—c.i.f. Hamburg or Düsseldorf and in DM; this is essential so that we could have enquiries made by several of our consular posts simultaneously.

But what I would recommend you to consider is coming out—or sending someone out here—to make an expert assessment on the spot of the prospects for your goods. If you will let us know in advance we will be happy to arrange contacts and interviews and, needless to say, we should be very happy to welcome you ourselves. For British exporters have great opportunities in Western Germany to increase their trade with the largest and most rapidly developing market in Europe. I do not think that these are opportunities which any British firm can afford to miss. I hope, therefore, that you will get in touch with me at: British Embassy, Bonn, Friedrich-Ebert-Allee 77—telephone Bonn 22021.

Editor's Note.—Baker Perkins, Ltd., Bedewell Division, have recently announced a contract for the supply of foundry equipment to E.G.O. Elektro-Gerate, Blane v. Fischer, Oberderingen, Wuttenburg.

The British firm will supply a completely automatic moulding line to work in conjunction with two 24 × 24-in Taccone diaphragm moulding machines. The plant will be capable of 150 moulds/hr and will include indexing mechanisms, roll-over and lowering devices, a closing device, automatic box separation and powered conveyors.

NEWS OF PERSONALITIES

Leslie Ingham, A.M.I.E.E., M.A.M.E.M.E., has joined the Electric Construction Co., Ltd., for sales development in the London and Southern Counties Area. He will be located at the company's London offices at 'Bushbury House', 57 Buckingham Gate, London, S.W.1.

Mr. Ingham joined the Chloride Electrical Storage Co., Ltd., in 1931 as a management trainee in the engineering section, later becoming assistant in the works manager's department. Following experience with the Metropolitan Vickers Electrical Co., Ltd., he joined the Lancashire Electric Power Co. at Manchester Headquarters, becoming assistant power sales engineer in 1938. He saw service as an Electrical Officer in the 1939-45 hostilities, being seconded as Lt.-Commander to the Canadian Navy in 1943-45.

Ben R. Shelley has arrived in U.K. from U.S.A. to assume duties as engine representative for Caterpillar Tractor Co., Ltd. His appointment coincides with the announcement that the full range of Caterpillar industrial, marine and diesel electric sets is now available in Great Britain. Twenty-three years with the parent company, Caterpillar Tractor Co., of Peoria, Illinois, U.S.A., he graduated through manufacturing and sales departments as a machinist apprentice, draughtsman, technical correspondent, and special engine representative for sales development.

John Thompson Conveyor Company, of Ettingshall, Wolverhampton, have appointed **P. D. Hunter** to be their London and Southern area sales engineer. He will operate from the John Thompson London office at 7th floor, Imperial House, Kingsway, W.C.2, Temple Bar 3216, and will be responsible for all sales and service in central London and the Home Counties. Mr. Hunter has assumed the duties previously covered by **J. M. Tudor,** who will now be situated at head office in Wolverhampton. Mr. Hunter was previously associated with Sovex, Ltd. The New Conveyor Company, and more recently Mechandling, and is an associate member of the Institute of Materials Handling.

Leslie Ingham

Ben R. Shelley

J. Firth

Robert Dempster & Sons, Ltd., announce that **J. Firth** has been appointed manager of their Mechanical Handling Division. Mr Firth was formerly sales manager of the Surface Division of Richard Sutcliffe, Ltd., Horbury, with whom he had been associated for 20 years.

Leslie F. Chamberlain is the newly appointed chairman of the Chamberlain Group of Companies. He succeeds the late W. E. Chamberlain.

British Jeffrey-Diamond, Ltd., announce that **C. F. Adams** has been appointed to the board of directors. Mr. Adams, who has been with the company for 22 years, has, for the greater part of that time, been manager of the London office and, for the past few years, general manager of the Crusher & Industrial Division. During the war, Mr. Adams was a major with the Royal Corps of Signals.

The Plessey Co., Ltd., announce the appointment of **R. E. Verguson, M.S.M.A.,** as commercial manager of a new grouping which includes the sheet metal division and

Leslie Chamberlain

R. E. Verguson

the Amar Tool and Gauge Co., Ltd., with the industrial hydraulics division, at Cheney Manor, Swindon.

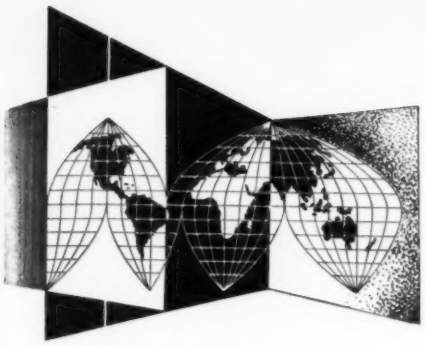
Opperman Gears, Ltd., announce the appointment of **A. Barton** as works manager. Mr. Barton served his apprenticeship in the motor industry, and afterwards joined Vickers-Armstrongs, Ltd. During the war he saw service with the special engineering branch attached to the British Forces in Europe. He subsequently worked for the Sudan Gezira Board at the mechanical engineering workshops.

Eric A. Robinson, M.C., M.I.Mech.E., has recently been appointed chairman of Stein Atkinson Vickers Hydraulics, Ltd., in place of H. C. J. Russell Smith, who has resigned but will remain on the Board. Mr. Robinson is chairman of The Superheater Co., Ltd., and a director of Stein & Atkinson, Ltd.

OBITUARIES

We regret to report the death of **Lew Hayman,** service manager at the Spalding depot of Levertons of Leeds.

We report with regret the death of **R. B. Dakin,** who was deputy chairman and joint managing director of Walter Somers, Ltd., of Halesowen. Mr. Dakin had been 46 years with the company and started work under the founder of the firm, Mr. Walter Somers.



BRITISH MECHANICAL HANDLING EQUIPMENT OVERSEAS

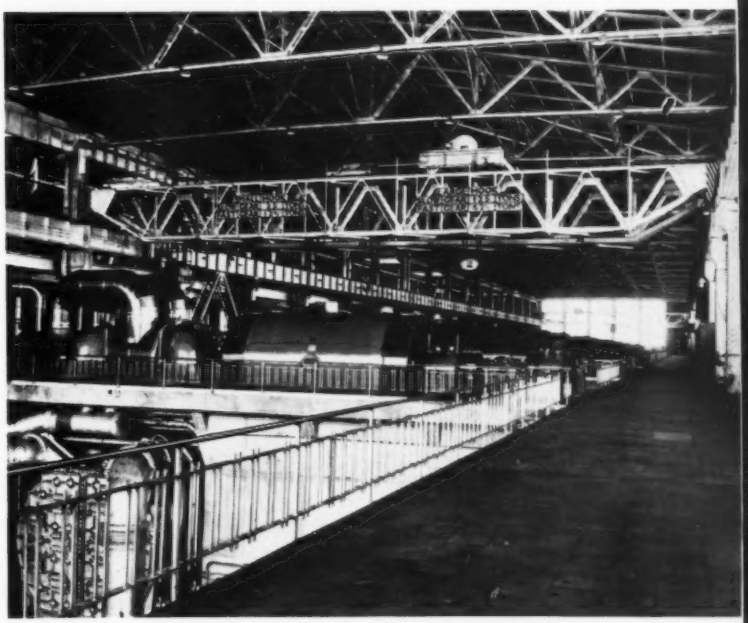
SINGAPORE. *Conveyancer T.C.6 diesel/petrol-powered fork truck, 6,000 lb capacity at 20-in load centre, assisting unloading of vessel in Singapore Harbour* →

← **NORWAY.** *Engaged on the removal of heavy overburden prior to excavation of the Songa Dam site in Norway, this British International BTD-20 Bullgrader must first clear a deep covering of snow. The dam is one of many being constructed in connection with the vast Tokke hydro electric scheme due for completion in 1963. Machines and operators face arduous conditions in difficult country 3,000 ft above sea level*

British mechanical handling equipment is to be found working in most countries of the world. Each year since the end of the war, sales to overseas customers have increased. Buyers from overseas flock to the Mechanical Handling Exhibitions (organized by this journal) held every two years in London, so great is the regard for British-made equipment.

In this feature, to be continued each month, we shall bring you brief details and illustrations of such British equipment designed for, or at work in, countries abroad.

Overseas readers requiring information on any type of British mechanical handling equipment, or names of manufacturers' agents or representatives in a particular country, are invited to write to the Editor.



SOUTH AFRICA
Herbert Morris 125-ton, 115-ft span electric overhead crane in the power station at Taibos, South Africa. →

Britische Förder- und Hebegeräte befinden sich in den mesiten Ländern der Erde im Einsatz. Seit Kriegsende steigern sich die Verkaufsziffern an ausländische Abnehmer von Jahr zu Jahr. Ein so grosses Ansehen geniessen Geräte britischer Herstellung, dass ausländische Käufer anlässlich der alle zwei Jahre von dieser Zeitschrift in London veranstalteten förder- und hebetechnischen Ausstellungen in Strömen herbeikommen.

In dieser monatlich fortgesetzten Artikelserie werden wir kurzgefasste Einzelheiten und Abbildungen britischer Geräte bringen, welche für das Ausland konstruiert bzw. dort bereits im Einsatz sind.

Ausländische Leser, welche an Auskünften über britische Förder- und Hebegeräte gliechwelcher Art, bzw. an Namen und Adressen der entsprechenden Hersteller, Agenten und Vertreter in irgend einem gegebenen Lande interessiert sind, werden gebeten, sich schriftlich an die Redaktion zu wenden.

HOLLAND
This Collis Motaveyor/Rolaveyor installation illustrates the infallible power of gravity which becomes a most economical and well-controlled force for conveying the skips of shuttles in a well-known Dutch textile factory

En la mayoría de os países del mundo puede hallarse funcionando equipo británico de manejo mecánico. Desde que terminó la guerra la venta de tal equipo a los compradores de ultramar ha venido aumentando sin cesar. Tan considerable es la estima en que se el equipo de fabricacion britanica en todo el mundo, que son numerosísimos los compradores extranjeros que se personan en Londres para visitar la Exposición de Manejo Mecánico (organizada por esta Revista) que se celebra cada dos años.

En esta sección, que aparecará todos los meses, les ofreceremos ligeros detalles e illustraciones de tal equipo británico diseñado para países extranjeros o funcionando en ellos.

Los lectores de ultramar que requiran información sobre cualquier equipo británico de manejo mecánico, o el nombre del agente o representante de los fabricantes en cualquier país en particular pueden escribir pidiéndola al Director de esta Revista.

S. RHODESIA. *A Muir-Hill 10B Dumper being loaded at a quarry in Bulawayo* →

Le matérial britannique de manutention mécanique se trouve en service dans la plupart des pays du monde. Chaque année, depuis la fin de la guerre, le chiffre des ventes à la clientèle des pays d'outremer s'est accru. Des acheteurs de tous les pays du monde accourent aux Expositions de la Manutention Mécanique (organisées par notre publication), qui ont lieu tous les deux ans à Londres, si haute est l'estime que l'on a pour le matériel de fabrication anglaise.

Dans cet article, à suivre tous le mois, nous vous présenterons des détails succincts et des illustrations du matériel anglais spécialement étudié pour et mis en service dans les pays étrangers.

Nous invitons cordialement les lecteurs de l'étranger à écrire à notre Rédacteur en Chef (The Editor) pous tous renseignements concernant un type quelconque de matériel anglais de manutention mécanique, ou les noms de fabricants, agents distributeurs ou représentants dans un pays donné.

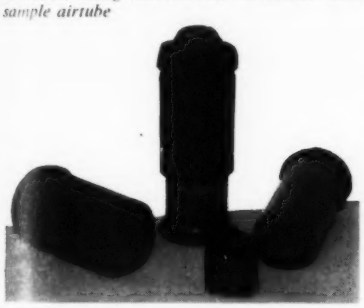
←
KENYA
Ransomes fork lift trucks handling palletized loads at East African Railway Co.'s docks at Mombasa

REVIEW OF NEW EQUIPMENT

STEEL SAMPLE CONVEYANCE BY AIRTUBE

High-speed analysis of samples in the course of a melt is of great importance in modern steel production, and time spent in transferring the sample from furnace to laboratory affects the rate of production, and the handling of samples while still hot can have distinct advantages. The new airtube system announced by the Lamson Engineering Co., Ltd., Hythe Road, London, N.W.10, is operated by compressed air and can carry samples weighing 4 lb at high temperatures and at speeds of 40-50 m.p.h.

A carrier being inserted into the Lamson steel sample airtube



Lamson airtube carriers and a typical steel sample

The carrier in which the sample is conveyed has internal measurements of 2 in dia by 4 in long. The head is in the form of a sleeve fitting over the carrier. The tubing in which it travels is of 3 in dia and can be laid underground, overhead or inside ducts. When the carrier is inserted in the end of the tube, a door is shut, automatically operating an air valve which admits compressed air for a predetermined period to propel it to the receiving end. The door then opens to allow another carrier to be inserted or one to be received. Normally only one tube is needed with carriers passing in both directions. Where traffic is heavy, however, a two-way system can be installed, using each tube for one direction only. This system has been extensively tested by one of the foremost steel manufacturers. The distance of 1,250 ft between the furnace and laboratory is traversed in 17 seconds at over 40 m.p.h.

AUTOMATICALLY CONTROLLED BULLDOZER

The new Sapper reardozer for use with Massey-Ferguson tractors represents a new approach to the problem of control and wheel adhesion encountered when wheel tractors are applied to earthmoving. It is carried by the normal three-point linkage and takes advantage of the Massey-Ferguson draught control system. It has been designed by the makers, Bomford and Evershed, Ltd., Salford Priors, Evesham, Worcs, to fill a gap in the range of equipment available for Massey-Ferguson 35 and 65 tractors.

The patented reversing mechanism enables it to respond to thrust in exactly the same way as, for instance, the Ferguson plough, and the weight of the implement is, therefore, automatically transferred between the cutting edge and rear axle, giving maximum wheel adhesion and penetration under all conditions. The operating linkage has been designed to give a closely controlled floating action, which enables an unskilled driver to make a first-class job, with instant response by the hydraulic system to variations in blade loading, and a higher operating speed can be maintained, saving time and tyre wear. Mounting of the blade on the three-point linkage combines ease of attachment with exceptional manœuvrability and low capital cost.

Available as optional extras are a scarifying grid, which will break-up the hardest-baked ground and when not in use can be pivoted up and locked, and, for driver comfort, a reversed control outfit, comprising a rearward-facing seat pillar, bringing brake, hydraulic and ancillary controls within easy reach.

A Massey-Ferguson tractor in operation with a Sapper automatically controlled reardozer

ADJUSTABLE DASHPOT

The Kinetrol precision dashpot, which has already found numerous applications in the fixed-rate form, is now available in an adjustable-rate version. Any numerical value of damping within a 10:1 range may be obtained by setting the calibrated knob to the desired rate. Unique characteristics of this silicone-filled damper are the absence of friction, ensuring purely viscous resistance and the elimination of leakage and backlash. This is because the shaft seal is a flexible rubber sleeve bonded to both the cover and shaft, and there is no surface at which sliding occurs. The use of die-cast components has permitted a large cut in the cost. Rates available are 2.0-2,000 in/rad/sec. There is also a differential-rate model which gives a large resistance in one direction only.

The new Kinetrol adjustable dashpot

Manufacturers are Kinetrol, Ltd., Trading Estate, Farnham, Surrey.

AUTOMATIC SHEET SORTING AND STACKING

The capacities of rolling mills and tinning plants for thin, flat products are generally so large that the conventional finishing line equipment is unable to cope with either the amount or variety of the output.

ABOVE LEFT
The Schloemann fully automatic sorting and stacking plant handling electrolytic tinned sheet

ABOVE
The Western fully automatic pallet loading machine

LEFT
Transferring grain from a vessel to a road vehicle by means of the new Aldersley Vac-U-Vator

Schloemann Aktiengesellschaft, Dusseldorf, Germany, have therefore developed a high-speed fully automatic plant for sorting and stacking sheets.

Upon entering the plant the gauge strip is first cut into sheets which are transferred by conveyor belt to the sorting belt. Faulty sheets are thrown off at either of two sorting stations, depending on the type of defect; perfect sheets proceed to the end of the sorting belt. The plant is designed to operate dependably, even at maximum speed, without damaging the surfaces of the material handled. A plant of this kind for dealing with electrolytic sheets in lengths of 14 in to 59 in was recently supplied to a foreign mill which operates at a maximum speed of 1,300 ft/min.

PNEUMATIC GRAIN HANDLING

The sole manufacturing and selling rights of the Vac-U-Vator pneumatic grain handling unit for all countries except U.S.A., Argentina, India, Korea and Japan have been acquired from Dunbar Kapple Inc., Illinois, U.S.A., by Aldersley Vacuvators, Ltd., Tettenhall, Wolverhampton.

Designed for handling most types of grain and other equally free-flowing materials without excessive moisture and dust content, it is a completely self-contained portable unit mounted on a wheeled chassis. Besides the transfer of grain to and from silos, rail and road vehicles, it is particularly adaptable for loading and unloading grain vessels.

It can be fitted with a Newage/S.M.C. 5·1-litre, 6-cyl diesel engine or 4,000-c.c. 6-cyl petrol unit, or where danger of fire is prevalent, a Higgs electric motor, developing 65 h.p. at 1,455 r.p.m., and larger pulleys and belts to cope with the higher torque starting loads. The diesel engine is rated at 62 b.h.p. at 2,000 r.p.m., at which speed fuel consumption is about 0·43 pints/b.h.p./hr on full load, or 2½-3½ gal/hr under normal running conditions. Where conveying and elevating distances are reasonable and practical, the machine should handle most types of grain at average capacities of between 20 and 23-25 tons/hr or even higher where site layouts tend towards the ideal. With only slight alteration the unit can be dismounted and used as a static installation on firm ground or on board a ship's deck. A number have been used for loading the grain vessel at departure port and then placed on deck for unloading operations at the port of destination.

FULLY AUTOMATIC PALLET LOADER

The Materials Handling Division of Western Manufacturing (Reading), Ltd., are now producing a range of fully automatic pallet loading machines, originally developed and produced in conjunction with the engineers of the Plastics Division of Imperial Chemical Industries, Ltd. The pallet loading machine has many advantages for manufacturers handling bulk raw materials or finished products. It can handle bags, sacks, crates or cartons with equal ease and, in fact, cope with any product normally palletized. The extreme accuracy of automatic pallet loading permits higher stacking than can be safely achieved by orthodox means. It is said to be possible to conserve up to 50 per cent of the normal storage space, and with modern bulk production methods the annual saving may amount to many thousands of pounds.

The speed of the machine is easily adjusted to suit a variable production rate, requires no special operator and can be supervised by the fork lift truck operator attending to the removal of the loaded pallets. The machine takes charge of the containers direct from the production line and uniformly arranges them in any desired pattern on the pallet until it is fully loaded. The pallet is then automatically ejected on to an off load section where it can be directly handled by fork lift truck.

Associated with the machine is a pallet dispenser. This is a magazine containing empty pallets which automatically feeds the machine. When the pallet loader is handling bags or sacks, these are passed through a vibro-flattening unit prior to the loader, thereby ensuring uniformity. Associated equipment, such as the vibro-flattener, powered roller conveyors and the empty pallet dispenser, can be obtained and individually fitted to existing systems if desired.

MINE TUB SHAKE-OUT

Manufactured by the Sinex Engineering Co., Ltd., Feltham, Middlesex, the new Sinex mine tub shake-out equipment is marketed exclusively by Holman Brothers, Ltd., Camborne, Cornwall. It can handle tubs of up to 5 tons capacity.

Ineffective and incomplete emptying of mine cars and pit tubs results in a gradual build-up of residual material which quickly sets into a concrete-like substance, occupying up to 20 per cent of the container capacity, representing serious financial loss where payments are based on full container output. Attempts to break up and remove this accumulation by manual scraping and thumping and by the use of pneumatic and electric tools are time-consuming, only partially effective, and may damage the containers. The regular use of the Sinex shake-out prevents build-up of deposits, and is said to have improved the overall efficiency of mines by up to 10 per cent.

It comprises a robust support frame in which is pivoted a tippler cage which accommodates tubs of up to 1 ton capacity. The cage is suspended by two

hanging trunnions from a beam structure which carries a Sinex 3,000-r.p.m. rotary electric high-amplitude vibrator. After being placed in the cage, the tubs are inverted and are vibrated for approximately 50 seconds when all deposits completely disintegrate and fall away. The rolled steel channel A frames which support the vibrator unit and cage are fitted with rubber shock and vibration absorbers, and bolt holes are provided for permanent installation and for grouting into concrete. The vibrator is suspended below the beam with anti-vibration mountings. To the sheet steel beam is attached at each end a hanging trunnion of the lower end of which is fitted a bearing journal of large surface area. The bearings are the pivot points for the tippler cage of steel plate and angle iron to form a rigid enclosure for the tub. The cage can be easily inverted by hand with a tub inside. Rails on the bottom of the cage are supplied to suit various gauges.

The vibrator operates with currents at 1½ amp. per phase at 400-440 volts. The centrifugal force varies between 4,000 and 7,500 lb, depending on the vibrator power requirement. Standard vibrators provide 3,000 r.p.m. vibrations with provision for amplitude variation. The totally enclosed and dust-proof electric motors can be wound to suit all 3-phase supplies and National Coal Board voltages. The vibrator is operated by a standard push-button starter.

The new Sinex mine tub shake-out which removes residual material from mine tubs and cars

SELF-LOCKING FOLDING BOX

A recent addition to the range of folding boxes produced by the Granby Box Co., Ltd., 359 Canal Road, Bradford, 2, originators of the Plysteel folding box, is a self-locking version which retains the advantages of collapsibility but is self-closing without the use of nails, fasteners or steel strapping. Like previous types, the body is made from plywood panels, joined and hinged by special steel corner strips, and folds flat when not in use. The lid and base lock into position and

A Granby self-locking folding box containing 2 cwt suspended by its lid. Both lid and base are held in position by the self-locking action

cannot be removed without extreme force or the use of a knife blade or similar lever.

Self-locking is achieved by a channel, formed along the edges of the lid and base, into which fit corresponding bars fixed to the inside of the body. A smooth, flush interior can, however, be provided if required. The lid and base can be assembled or removed in a few seconds, and nails or steel strapping are unnecessary except where extra security is required, thus saving both time and materials. The extra cost as compared with that of a standard Plysteel folding box is no more than a few coppers.

VARIABLE-DEPTH BOX STILLAGE

Another stillage has been added to the standard range produced by W. Groom, Ltd., West Marsh Road, Spalding, Lincs. The new product is a variable-depth box stillage with a series of interlocking surrounds which permit the depth to be varied in 6 in steps from 6 in to 36 in. The surrounds are of 6 × 1 in softwood, and the first is locked to the stillage by sturdy angle-iron corner pieces. Succeeding surrounds are strengthened by

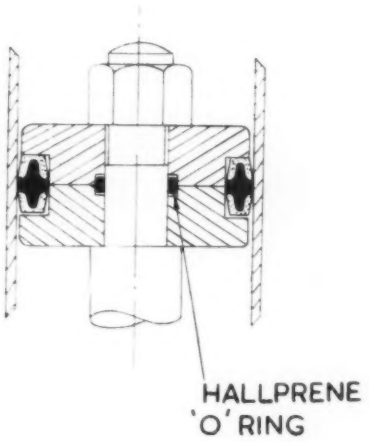
Showing how the height of the new Groom box stillage can be varied by removing or adding interlocking surrounds

triangular-sectioned timber corner pieces which take up little internal space, aid rigidity and provide the locking system. Supplies can be delivered at very short notice.

DOUBLE-ACTING FLUID SEAL

Conventional practice in sealing double-action mechanism is to use two seals back to back, one operating on the inward and the other on the outward stroke. The difficulty arises in dealing with fluid accumulations between these seals; however efficient they may be in resisting leakage under pressure, there is generally some fluid 'creep' between piston and seal. The pocket of fluid thus formed can cause rapid wear of the seals if allowed to remain. It moves from one seal to the other as the piston reciprocates, so that both seals are subject to excessive wear, whether by continuous flexing because the seal is unseated or by damage to the sealing lips. Usually this wear is minimized by use of vents to allow fluid to escape from behind the seals.

The new Hallprene double-acting fluid seal introduced by Hall and Hall, Ltd Oldfield Works, Hampton, Middlesex, is claimed to eliminate many of the difficulties encountered in the design and

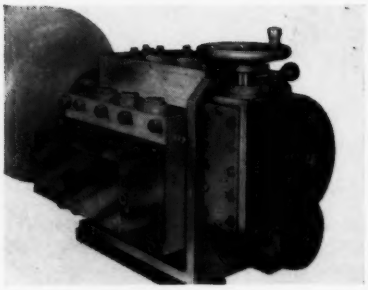


A double-acting hydraulic piston in section fitted with a Hallprene double-acting fluid seal

operation of double-acting hydraulic pistons. It is based on the Hallprene patent fluid seal, and is fundamentally two impregnated-fabric U-seals bonded to a rubber core. It can be mounted centrally in a groove on the piston spigot, filling the diametrical clearance between spigot and cylinder. Available in a wide range of standard sizes, the new seals facilitate more economical design of double-acting pistons and allow for longer operation before servicing.

VARIABLE FLOW PUMP

Sutcliffe Hydraulics, Ltd., Speedwell Works, Whitwood, Castleford, have introduced a new multi-piston hydraulic variable flow pump operated by camshafts running in roller bearings. The delivery and suction valves are mitre-seated, and the basis of the design is simple unit



The Sutcliffe multi-piston hydraulic variable flow pump

construction with strength of components to give hard continuous service.

Pairs of pistons operate with common suction and delivery valves, and the relative position of the camshaft driving one piston is altered with regard to the camshaft driving the other piston, so giving an infinitely variable flow from zero to full capacity. Full pressure is produced down to zero capacity, and the pump may be run in either direction to suit the prime mover.

The present range of pumps have capacities from 7½ g.p.m. to 50 g.p.m. with pressures up to 2,000 p.s.i., and various controls, such as manual, mechanical, electronic or automatic, can be fitted to suit the conditions of control required. The pumps can be supplied separately or in the form of power packs.

FOR EASY MOVEMENT OF HEAVY LOADS

To facilitate multi-lateral movement of large and heavy loads of many kinds in rolling mills, shipyards, atomic plants and factories J. Collis and Sons, Ltd., Regent Square, Gray's Inn Road, London, W.C.1, have produced a heavy-duty model of their TransVeyor ball assembly. It comprises a 2-in carbon chrome steel ball cradled in a hundred smaller balls and housed in a steel forging fitted with a cap. It has a load capacity of 750 lb. The cap is a malleable casting and retains an oil seal and washer which excludes dust and dirt and ensures freedom of movement

Heavy-duty version of the Collis TransVeyor with 2-in ball assembly

under all conditions. Lubrication is by grease gun.

TransVeyors can be mounted on vertical steel tubes, to facilitate handling of metal sheets in rolling mills, or on recessed surfaces, to provide a bed on which large objects can be moved in any direction with finger-tip pressure for cutting, bending, welding or other processes. For shock loading a cushioned mounting is recommended.

TRADE NOTES

'Modac' Connectors Transferred

The Plessey Co., Ltd., announce that production of the entire range of Modac connectors, hitherto carried out by their associate company, Modern Acoustics, Ltd., at Boreham Wood, Herts, has now been transferred to the Wiring and Connectors Division of Plessey at Cheney Manor, Swindon.

This is in accordance with the company's policy to centralize the production of allied products and services, and the new factory at Cheney Manor now accommodates the entire production of electrical connectors, performed wiring and ignition harness.

Consolidated Pneumatic

The Consolidated Pneumatic Tool Co., Ltd., of Dawes Road, London, S.W.6, announce the opening of a new district office in Bristol to serve the West of England. J. D. Glover will manage the new office, located at 1 Bedminster Down Road, Bristol 3. Telephone: Bristol 63736. The office will cover the counties of Somerset, Devon, Cornwall and part of Gloucester.

The company's branch office at Bridgend, which formerly served this area, will continue to serve the South Wales counties, Hereford and part of Gloucester.

Companies Change their Names

On January 1st, 1960, the British Thomson-Houston Co., Metropolitan-Vickers Electrical Co., and Siemens Edison Swan, Ltd., change their names to Associated Electrical Industries (Rugby), Ltd., Associated Electrical Industries (Manchester), Ltd., and Associated Electrical Industries (Woolwich), Ltd., respectively.

At the same time five new product divisions of Associated Electrical Industries are announced. They are as follows: 1. Cable Division; 2. Construction Division. These combine the interests of the S.E.S. cables division with those of W. T. Henley's Telegraph Works Co., Ltd., and Liverpool Electric Cables, Ltd.; 3. Telecommunications Division; 4. Radio and Electronic Components Division. The telecommunications division has hitherto traded as a product division of Siemens Edison Swan, Ltd.

The four divisions mentioned so far will be managed by Associated Electrical Industries (Woolwich), Ltd. (formerly S.E.S.). 5. Instrument Division. This division combines the interests of Sunvic Control, Ltd., with the instrument and meter, X-ray, and scientific apparatus departments of Metropolitan-Vickers and will be managed by Associated Electrical Industries (Manchester), Ltd. (formerly M-V.).

So from January 1st, 1960, the total of A.E.I. product divisions to be established becomes 12, and the famous companies whose names are to change will cease to trade, but will manage a number of A.E.I. product divisions. Their employees will be transferred to A.E.I. employment.

Birlec, Ltd., the heat treatment and furnace manufacturing company, will be renamed A.E.I.-Birlec, Ltd., and will be managed by Associated Electrical Industries (Rugby), Ltd. (formerly B.T.H.).

Lang Pneumatic, Ltd.

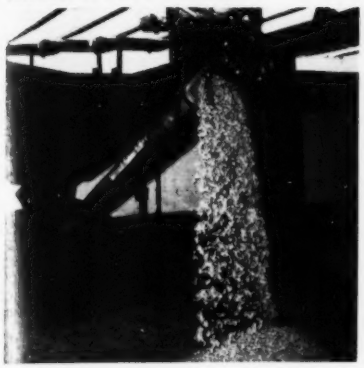
To improve communications Telex has been installed in the head office of Lang Pneumatic, Ltd., Owen Road, Wolverhampton, and also at the London office, 69 New Cavendish Street, W.1. The numbers are Telex Wolverhampton 33193, Telex London 23128. For the benefit of present and prospective customers in the Northern area, a branch office has been opened at 107 Pinstone Street, Sheffield, 1. Telephone Sheffield 27865. Technical representatives J. M. Kenworth & G. Shaw, A.M.I.Prod.E., will operate from here.

Renold Chains, Ltd.

With a view to providing improved facilities and amenities for their customers, Renold Chains, Ltd., have moved their Northern District branch office from Scotswood Road, Newcastle upon Tyne, to Queensbury North, Team Valley, Gateshead-on-Tyne, 11, where an increased range of stock products are available 'off the shelf'.

(*continued on page* 55)

(*Right*) *Renold Chains, Ltd.'s new premises at Queensway North, Team Valley, Gateshead-on-Tyne*



(Above) One of the Mayrath conveyors which are now being used at S. Swonnell & Sons, Ltd., to speed up the process of emptying the steeps prior to spreading for the 'flooring' process. The photograph shows a conveyor in operation handling 36 quarters of grain in 20-25 min working at an angle of 20 deg

(Right) The emptying of steeps at S. Swonnell & Sons, Ltd., of Oulton Broad, Lowestoft, has been mechanized. The grain travels up a Mayrath screw conveyor into the hopper of a Redler Sinden mobile piler and spreader. The photograph shows the process in operation with the barley being shot over the entire area of the couch, thereby eliminating the need for manual handling except in trimming and levelling

Mayrath Speeds Malt Process

Before barley is ready for kilning and malting, it has to go through a 'flooring' process which takes 9-11 days. This tradition in the malting world starts with the emptying of barley from large-capacity 'steeps' where the grain is soaked in preparation for the 'couches', where the barley germinates. Most methods of steep emptying are mostly based on manual labour. Up to 10 tons of wet barley can be handled during 'steep' emptying. In an effort to eliminate this tedious operation, S. Swonnell & Sons, Ltd., of Oulton Broad, Lowestoft, decided to mechanize.

There are four working floors in the pale malt building each served by a 'steep' of 36 quarters capacity. Previously barley was run out of the steep on to the floor and shovelled into barrows, running on overhead rails for transportation to the couch. Due to the size of the steeps, which empty by gravity, grain outlets are too near the floor for barrows to be wheeled under them. Swonnells needed a more economic means whereby the grain could be lifted from the steep outlet, mechanically, to enable quicker emptying.

Permanently installed Mayrath screw conveyors which individually handled 36 quarters of grain in 20-25 mins were used, with the conveyor working at an angle of 20 deg. With the Mayrath, steeped corn is emptied on to the floor where the inlet of the conveyor is situated. The barley is then conveyed directly up the tube of the conveyor and ejected into the hopper of a Redler Sinden mobile piler and spreader. This shoots the barley over the entire area of the couch and eliminates the need for manual handling except in trimming and levelling. A 16-ft Mayrath with a 6-in bore was chosen for its high output and also the fact that it causes no damage to the grain.

The Mayrath conveyors were supplied by Gordon Felber & Co., Ltd., Oxford Circus, London, W.1.

Fischer Bearings Co., Ltd.

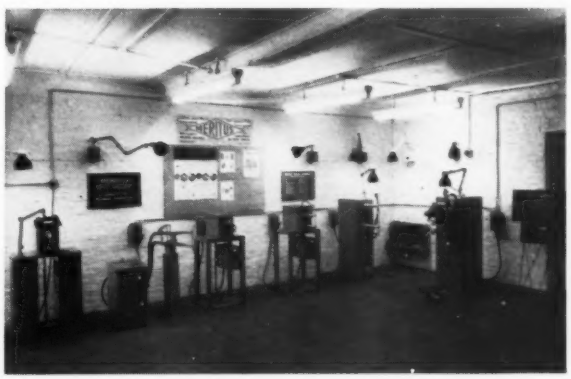
The Timken Roller Bearing Co., and The Fafnir Bearing Co., of New Britain, Connecticut, U.S.A., have announced that an agreement will shortly be concluded by which a recently formed subsidiary of Fafnir Bearing Co., Ltd., will purchase the business of Fischer Bearings Co., Ltd., a Timken subsidiary.

The sale of Fischer, until recently owned by the former British Timken, Ltd., results from the Timken decision to confine their interest to the manufacture of tapered roller bearings throughout the world. They will, however, continue for the present to distribute FBC bearings for replacement purposes in Britain, through their subsidiary, Timken Stockists, and in Australia, South Africa and Canada, through their branches in those countries.

The purchase of Fischer by Fafnir marks the latter's first entry into foreign manufacture. The company employs 5,000 people in six factories in New Britain, and they claim to be the largest independent manufacturers of bearings in the U.S.A. It is intended that Fafnir's British products will be marketed under the Fafnir name and that the business will be expanded to meet the anticipated increase in demand in both British and world markets and in particular the overseas factories of Fafnir's American customers.

Aerox, Ltd.

As a result of steadily increasing demand for aeration, filtration and fluidizing equipment the above firm have outgrown their premises at Crawley, and have now acquired a factory at Chalford, Stroud, in Gloucestershire, for their Engineering Section. The increased floor space of the new factory, five times greater than that of the old, will mean that Aerox, Ltd., will



(Right) Meritus (Barnet), Ltd., announce the opening of a welding demonstration workshop at their factory at Barnet, Herts. A comprehensive range of their welding machines can be seen and demonstrated at any time, including Saturdays, by appointment

be able to handle an even greater volume of work. They will manufacture all forms of equipment incorporating porous ceramic filter elements, although the elements will continue to be made at the main Hillington (Glasgow) Plant.

Purchasing as an Aid to Productivity

A conference, organized by the Willesden & Hendon Productivity Committee, will be held at the Headquarters of the F.B.I. at 21 Tothill Street, Westminster, S.W.1, on January 27th, 1960. Both large and small organizations will find the conference of special interest to all levels of management as well as people concerned with purchasing.

Chairman will be M. Seaman, Director and General Manager of British Oxygen Engineering Co. Admission fee: Two guineas. Requests for details and reservations, together with remittance, should be sent to: D. I. Duncan, A.E.I., Switchgear Division, 20 Neasden Lane, Willesden, N.W.10.

'Best Suggestion'

Small & Parkes, Ltd., Hendham Vale Works, Manchester 9, operate a successful Works Suggestion scheme, with money awards made for suggestions which are adopted. There is also a 'Best Suggestion of the Year' prize. The scheme has been running for 10 years, and over 1,100 suggestions have been made, of which almost 600 have been adopted.

An unusual suggestion was recently submitted by H. Kirkpatrick of the Engineers' Shop, who advocated the packing of brake-lining rivets in transparent-plastic bags to replace existing linen bags. The method is cheaper, eliminates labelling, and is generally more efficient. Mr. Kirkpatrick was awarded £170, calculated on expenditure saved, together with £10 for the 'Best Suggestion' prize.

New Address

Elliott Brothers (London), Ltd., a member of the Elliott-Automation Group, announce that their South West England and South Wales Branch office has moved to 55 Westgate Chambers, Newport, Monmouthshire. Telephone: Newport 65710.

Hoover, Limited

In our October issue, page 564, we published an article 'Materials Handling Development at Hoover, Limited'. Fig. 11 showed a specially designed coil strip transporter truck which was stated to have been produced by Atlas Truck Co., Ltd. This was incorrect. The truck was manufactured by Andreasen-Atlas, Ltd., of Green Lane, Hounslow, Middlesex.

1960 John Morris Memorial Award

In addition to the premier award, value £550, prizes of £25, £15, and £10 will be given by the British Industrial Truck Association for ideas concerning the use of industrial trucks. The major award will once again be a grant to enable the selected candidate to attend the 7th Annual Material Handling Training Course at Lake Placid, U.S.A., in June 1960.

Candidates, who must be sponsored by their employers, will be required to write a Paper on: The development, performance and use of Industrial Trucks within our modern economy and the evolution of new forms of mobile materials handling equipment. If possible, illustrations, models, and diagrams of suggested equipments, handling layouts, etc., should be included and the title must convey in general terms the contents of the Paper. Requests for full particulars and application form should be made as soon as possible to: The Secretaries, British Industrial Truck Association, 94/98 Petty France, London, S.W.1.

(Below) The photograph shows Swissair's new, specially constructed loading platform, designed to speed up cargo handling at Zurich Airport. Previously goods arriving by lorry or van had to be handled twice before being loaded in the hold of the aircraft, whereas now the entire vehicle, plus goods, is driven on to the mobile platform alongside the aircraft and raised level with the loading hatches in 80 seconds. The load may weigh up to 10 tons and its base may measure up to 9 ft 4 in by 24 ft

FEBRUARY

The above issue will contain the following articles:—

Handling with Industrial Trucks Part 5

Induction Couplings

Ring Main Pneumatic Tube System

Non-Fixed Conveyors and Elevators Part 19

A Conveyor for Glass

and Regular Features

PUBLICATIONS RECEIVED

Metalectric Furnaces, Ltd.

The above company have published a new Metalectric leaflet No. M4b, entitled 'Standard Box Type Furnaces'. Copies are available from Cornwall Road, Smethwick 40, Staffs.

Keir & Cawder News

The Keir & Cawder Group of Bishopbriggs, Glasgow, have recently issued the Summer 1959 number of their journal, giving details of their recent activities and developments.

Crofts (Engineers), Ltd.

These manufacturers, of Bradford, 3, have produced a leaflet dealing with their Electrically Released Magnetic Brakes, Type B. A further leaflet entitled 'Steel Castings' is also available.

Ab Bygg - och Transportekonomi

The above company, of Sweden, have published three leaflets detailing their BT Hydraulic Stackers, Type BT SV; the BT Lifter; and BT Hydraulic Pallet Lift Trucks. All information as to their products in Great Britain is obtainable from Rolatruc, Ltd., 20 Old Compton Street, London, W.1.

Angus Gear Book

George Angus & Co., Ltd., 152-158 Westate Road, Newcastle upon Tyne 1, have produced a technical reference book providing information on all aspects of

(Continued on page 57)

gears and gear-cutting. It is available to engineering students at a special concession price of 7s. 6d., the regular price being 15s.

'EUC' News
Volume 5, Number 2, of the above publication has recently been issued by Blackwood Hodge, 25 Berkeley Square, London, W.1.

Morse Chain Division, Borg-Warner, Ltd.
The above have just published a revised version of their Industrial Chain Drive Data Book, Catalogue No. 959. Copies are available from this company at Letchworth, Herts.

The Mond Nickel Company, Ltd.
The above company, of Thames House, Millbank, London, S.W.1, have produced a further publication in the series dealing with the development of S.G. Iron. The new publication, which is fully illustrated, describes in detail the properties of S.G. Iron and lists a number of applications.

The Simon Magazine
The October, 1959, number of the Simon Engineering Group's journal has just been published, giving details of the company's activities.

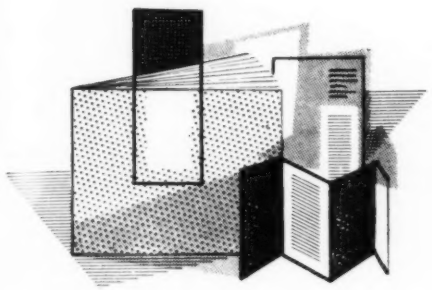
Adams Bros. & Burnley, Ltd.
The above firm, of Elmgrove Road, Harrow, Middlesex, have issued their latest brochure which gives details of their various capacities.

Exporting to the Middle East
The Advisory Council on Middle East Trade has published a booklet entitled as above, describing the opportunities which exist for the expansion of British trade with the Middle East. This booklet, issued free of charge, is available from the Board of Trade, Directories and Notices Section, Room 0348, Horse Guards Avenue, London, S.W.1.

Higgs Motors, Ltd.
A booklet entitled 'Starting from Scratch' has been published by the above company, of Witton, Birmingham, 6. This describes the company's activities from its commencement in 1912.

The English Electric Company, Ltd.
The following new publications have been issued by these manufacturers of Stafford: ST/122 Steam Turbines; MR/111 Marine Steam Turbines; GT/103 Gas Turbines; DE/217 Diesel Engines; PS/133 Induction Motors; DM/257 High Slip, High Torque Motors.

Butterfield News
W. P. Butterfield, Ltd., of Shipley, have recently published the Summer 1959 number of their house magazine, describing the company's latest activities.



ABSTRACTS AND REFERENCES

Articles on mechanical handling published in all technical and industrial journals of the world are indexed and abstracted below. Whenever it is known, the published price of the journal containing the article is given.

The addresses of the publications concerned are given and applications for copies of the journals mentioned should be made direct.

HANDLING SCRAP MATERIALS

Scrap Handler Attachment. *Maintenance*, One River Road, Cos Cab, Connecticut, U.S.A. October 1959. P. 31. $3 annual subscription.

For loading vehicles with large loads of scrap material not easily handled with the normal type of bucket, a 1,200-lb capacity hydraulic attachment has been developed for the Yale Y-18 industrial tractor shovel. This, it is stated in the article, is capable of dumping at a height of 7 ft. The attachment consists of three main components: seven rigid carrying forks welded to a 48-in wide carriage, four more widely spaced clamping forks, which close against the carrying units to hold the load, and separately controlled kick-off forks which sweep the material from the carrying surface when loading a vehicle.

FUEL CELL ELECTRIC TRUCK

Forecast 80 per cent Efficiency for Experimental Tractor Driven by Fuel Cells. *Product Engineering*, 330 W. 42nd Street, New York 36, N.Y., U.S.A. November 1959. P. 19. 50c.

Brief reference is made to a standard tractor modified so that it can be powered for experimental purposes by fuel cells. A total of 1,008 cells, each measuring 12 × 12 × ¼ in, are arranged in four banks of 112 units, each unit composed of nine cells. The cells convert chemical into electrical energy, utilizing a propane gas mixture as fuel with oxygen or air as the oxidizer. Each cell generates about 1 V, and the total electrical output is 15 kW, sufficient to exert a drawbar pull of 3,000 lb. It is believed that an efficiency of 80 per cent, twice that of a diesel engine, can be developed.

ENGINE COMPRESSION BREAKING

New Exhaust Brake Features Stainless Design for Safety. *Western Metalworking*, 2035 Miramar Street, Los Angeles 57, California, U.S.A. October 1959. P. 62.

The new design of engine-exhaust brake described and illustrated is applicable not only to road vehicles, but to engine-driven construction, earthmoving, materials handling equipment, mining and railway locomotives and for retarding the motions of cranes, winches, well diggers, mine face breakers and similar stationary equipment powered directly by internal combustion engines.

It consists of a stainless steel butterfly valve and shaft in a housing bolted directly to a stainless-steel exhaust manifold outlet. Under the driver's control, the butterfly valve, when closed, acts as a baffle to build up pressure of the engine's exhaust gases with retarding effect.

FOR DEMOLISHING BRICK WALLS

Brick Demolition Grab. *World Construction*, 22 West Maple Street, Chicago, Illinois, U.S.A. October 1959. P. 55. $8.50 annual subscription.

For demolishing brick walls, a new lightweight grab, it is stated, can take large chunks of brickwork for loading directly into trucks. Advantages are that breakage and quantity of rubble are reduced, so that many bricks can be reclaimed. The grab is made to grip the wall between a pair of large-area vertical steel jaw plates that can be adjusted to accommodate walls of varying thicknesses.

ON-AND-OFF-VEHICLE CONVEYOR

Loading-Unloading Conveyor for Packages. *Packaging Review*, Carlton House, Great Queen Street, London, W.C.2. November 1959. P. 83. 3s.

A high-speed belt conveyor for loading a delivery vehicle and unloading it at customers' premises is briefly described. The framework is of high-grade aluminium alloy extruded sections, which is resistant to corrosion and does not require painting. The standard model can handle packages, sacks and other small units up to 120 lb in weight; with ball-bearing idlers, heavier loads can be carried, and the fitting of troughing idlers permits bulk loads to be handled.

HIGH-CAPACITY VIBRATORY COMPACTOR

12 Shoes Pack 1,500 T.P.H. *Engineering News Record*, 330 W. 42nd Street, New York 36, N.Y., U.S.A. October 29th, 1959. P. 43. 50c.

Said to be the world's highest-capacity vibratory compactor that cuts compacting time by 50 to 75 per cent, a new machine described has two engines, one for propelling and the other for the vibratory work. It is stated that it will pack down up to 1,500 tons of rock and sand screen-

ASSOCIATED ILIFFE TECHNICAL BOOKS

Books Recommended by

'MECHANICAL HANDLING'

COST ACCOUNTING AND THE ENGINEER: A Text-Book for Students and Apprentices

Kenneth B. Mitchell, A.C.W.A., Aff.I.W.M. 10s. 6d. By post 11s. 4d.

ELECTRONIC COMPUTERS: Principles and Applications

Edited by T. E. Ivall. 25s. By post 26s.

ERECTION OF CONSTRUCTIONAL STEELWORK: A Text-Book for Students and Site-Engineers

Thomas Barron, A.M.I.Struct.E., A.M.Inst.W. 15s. By post 16s. 1d.

MATERIAL HANDLING IN WORKS STORES, SECOND EDITION: The Fork-Lift Truck and Pallet System

L. J. Hoefkens. 18s. By post 19s.

PRINCIPLES OF MASS AND FLOW PRODUCTION

Frank G. Woollard, M.B.E., M.I.Mech.E., M.I.Prod.E., M.S.A.E. 25s. By post 26s. 4d.

PROGRESS IN CARGO HANDLING, VOL. II

63s. By post 64s. 9d.

Obtainable from all booksellers or direct from

THE PUBLISHING DEPT.
DORSET HOUSE
STAMFORD ST., LONDON, S.E.1

ings per hour. It has two 15-ft rows of vibrating shoes set in tandem, one row of six shoes ahead of the front axle and a similar row behind it. The shoes are hydraulically operated and controlled and can be actuated in various combinations all at once.

Measuring 26 ft 9 in long, 9 ft 10½ in wide and 10 ft 2 in high, the machine has a maximum gross weight of 26,900 lb. Tandem rear axles, both driving, give a highway travelling speed of 24 m.p.h. and from 26 ft to 268 ft/min during compacting operations. The driving wheels are fitted with air-boosted brakes and power steering is installed.

WATER CONVEYANCE

Try Water for Bruise-Free Conveying. *Material Handling Engineering*, 812 Huron Road, Cleveland 15, Ohio, U.S.A. October 1959. P. 72. $1.

In a short article is described how tomatoes are conveyed in large quantities by a water channel to a cannery in southern California. Four electrically driven vertical centrifugal pumps of 3,000 g.p.m. capacity keep water flowing in a concrete flume, or channel, which is 3 ft wide, 2 ft deep and 750 ft long. Two of the pumps take water from a sump and deliver it into the starting end of the flume, and the other two at the finishing end return it to the sump through a 16-in pipe.

More than 200 trucks bring palletized tomatoes daily to the receiving section of the cannery where they are unloaded and stacked by fork lift trucks. When the canning plant calls for them, the tomatoes are dumped into a water bath where they are picked up by a wire-belt conveyor and taken to be cleaned by a water spray supplied by a 1,200-g.p.m. 2-stage turbine pump. After cleaning, they fall off the conveyor into the flume and the flow of floating tomatoes is directed into an open suction header. From there it flows unimpeded into five equal rubber-faced channels where the tomatoes are picked up on belts and conveyed to the inspection department prior to processing.

PREVENTING OVER-FILLING OF BINS

Bin Level Control. *Automation*, Penton Building, Cleveland 13, Ohio, U.S.A. November 1959. P. 144.

Where bins are filled by conveyor belts or elevators over-filling can be automatically prevented by the use of a simple device briefly described. It consists of a pendant float which operates a sensitive enclosed electric switch. This is mounted in a bin or tank and, as the level of the material fed into it rises, at a predetermined point the switch stops the conveyor or elevator. It can also be installed to give a light or sound warning. There are three types of control: normal duty for light to medium granular materials, explosion-proof for use in hazardous locations, and heavy-duty for heavy, lumpy materials.

WELDED ALUMINIUM CRANE BOOM

Aluminium Boom Used for Construction in Canada. By Earle H. Weichel, *Welding Engineer*, P.O. Box, 28 Morton Grove, Illinois, U.S.A. November 1959. Pp. 69 and 71. 50c.

Said to be the tallest in North America, the aluminium crane boom described is in use around Ontario, Canada. It was weld-assembled from 4,500 ft of tubing in four weeks. The main section measures 110 ft long and 60 × 48 in at its widest point. An angle jib adds another 30 ft to the overall length. The top and base of the main boom are each 20 ft long and four 20-ft sections and one 10-ft section allow for increasing the boom length to its limit in increments of 10 ft. The sections are held together by spigot and bolt-type joints. The boom weighs only 2,600 lb, as compared with 8,000 lb if of steel, thus increasing the payload by 4,500 lb.

INCREASED CONVEYOR BELT CAPACITY

New Belt Permits 45-deg Idlers for Ores. *Engineering and Mining Journal*, 330 W. 42nd Street, New York, N.Y., U.S.A. October 1959. P. 102.

Particulars are given of a new conveyor belt designed to operate with 45-deg idlers and handle the same ores and minerals which the more conventional belts with 20-deg idlers carry. Savings in cost, time and maintenance are claimed. With the 45-deg idlers it is estimated that there is a 25 per cent increase in capacity. The belt is designed to trough readily and resist fatigue from lateral flexing. It is made up of a series of centre plies and a nylon envelope which completely wraps around the centre, which may be of cotton or synthetic fibres. Elimination of damage from pinching and full contact with the centre roller are said to be basic advantages. Others claimed are: reduced belt wear, more effective skirt boards are possible, 'beam effect' is increased and spillage reduced and off-centre loading has a less pronounced effect. The belt is not recommended for conveying hot materials, and for proper operation a minimum speed of 400 ft/min is required.

HANDLING IN ANY DIRECTION

Manoeuvrable Truck. *Modern Power and Engineering*, 481 University Avenue, Toronto, Ontario, Canada. October 1959. P. 199.

Described as the answer to the universal material-handling problem, a new electric lift truck has steering equipment permitting it to be traversed in any direction at any angle, carrying any shape of load. The steering gear and twin-drive motors are operated by one control lever, providing forward and reverse turning without the use of the steering wheel, which, however, is used for angle and side movements. The truck is thus able to utilize space hitherto unused because conventional lift trucks could not manoeuvre loads into the same confined areas. It is also easier to steer it in tight aisles and around corners and to stack at right angles.

ELECTRONICALLY CONTROLLED CONVEYOR

Constant ...d Conveyor. *Automation Progress*, Leonard Hill House, Eden Street, London, N.W.1. October 1959. P. 352. £1 10s. annual subscription.

For feeding materials at a constant rate is described a new machine, made in East Germany, which operates under electronic control. It has two conveyor belts, one for feeding and the other for weighing, driven separately by electric motors. The material handled drops from a hopper on to the feeder belt and pours on to the weighing belt moving in the opposite direction below it. By means of a sliding weight running on a lever, the weighing belt is counterbalanced and the desired load is set. Weight variations causing deviations by the weighbeam are sensed, measured by an inductive or capacitance pick-up and transduced into an analogue voltage which controls the speed of the feeder belt accordingly. As the weighing belt speed is constant a constant feed rate is ensured.

PALLETIZING COILS AUTOMATICALLY

Turnover Cradle Speeds Handling of Heavy Coiled Materials. *American Machinist*, 330 West 42nd Street, New York 36, N.Y., U.S.A. November 2nd, 1959. P. 148.

Said to offer six times the efficiency of previous methods, a 20,000-lb capacity cradle described automatically rotates and palletizes rolls of coiled materials and permits stacking in a manner that saves considerable floor space, eliminates edge-shaping and dangerous band breakage. A coil is placed vertically on the cradle with a fork lift truck against the pallet. The cradle then rotates 80 deg horizontally and 90 deg vertically. In less than 20 seconds this palletizes the coil and rotates it so that it faces the truck ready for removal. The unit occupies about 35 sq. ft. of floor space and can be moved about by a 7,000-lb fork lift truck.

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